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The Coast Guard Engineer's Digest

U.S. Department of Transportation
United States Coast Guard

CG 133
Volume 23
Number 228
Fall 1985/Winter 1986

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The Coast Guard **Engineer's Digest**

United States
Department of Transportation
CG-133

Chief, Office of Engineering
RADM K. G. Wiman
Deputy Chief, Office of Engineering
CAPT D. L. Hoffer
Editor
Annette M. Nieves

The Coast Guard **Engineer's Digest** is an official publication of the Office of Engineering, U.S. Coast Guard Headquarters, Washington, D.C. Now published quarterly, the **Digest** has been a medium for communicating new ideas and technology of interest to Coast Guard engineers since April 1933.

The **Digest** is a professional journal for the publication of research papers, special studies and general interest articles aimed at advancing engineering in the Coast Guard.

While some material for the **Digest** is reprinted from other technical publications, most papers are submitted from the field by Coast Guard engineers and engineering managers, both military and civilian.

The Office of Engineering encourages all Coast Guard personnel in engineering-related fields to share their ideas, experiences, successes, and failures with the Coast Guard engineering community by submitting articles and papers for publication in the **Digest**.

Observe the following guidelines when submitting material for publication:

- Manuscripts should be typed double spaced on one side of 8½ x 11-inch white paper, leaving at least a 1-inch margin on all sides.
- Original articles by Coast Guard personnel (civilian and military) should have a byline, giving name, title, and unit, and a short biography of the author.
- Illustrations—glossy black and white photographs or line drawings—should be approximately 8 x 10 inches in size. In cases where the author does not have adequate facilities for producing finished art, the **Digest** can have artwork made up from the sketches.
- Complete figure captions and figure numbers should be listed on a separate sheet of paper or taped to the back of each illustration. Do not use staples or paper clips on photographs. Protect illustrations for mailing by placing them between pieces of stiff cardboard.

Send articles (original and one copy), letters, photographs, suggestions, etc., to:

Editor, **Engineer's Digest**
U.S. Coast Guard Headquarters (G-Eg/62)
Washington, D.C. 20593

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The **Engineer's Digest** is compiled in the Office of Engineering, U.S. Coast Guard Headquarters, and is printed by the Government Printing Office. No advertising is permitted, and no subscriptions are available. Individual issues may be requested from the editor.

The contents of the **Engineer's Digest** are for information only, and should not be construed as altering or superseding official regulations, orders, or directives. The ideas and opinions expressed are those of the individual authors and should not be considered to be the official views of the Commandant.

This publication is intended for all hands. Commanding Officers should take the necessary steps to make it available to all military and civilian personnel within their commands

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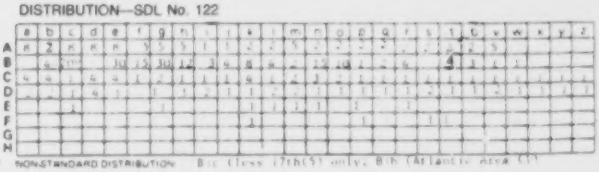

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Front Cover: USCGC Farallon (WPB 1301)—the first of 16 Island Class WPB's—being launched.

From the Editor

Dear Readers:

Now that the holidays are over, it is time to move forward in the new year. But, the year is not the only new change in the Office of Engineering, since the past year brought a new **Engineer's Digest** editor on board. I would like to take this opportunity to introduce myself.

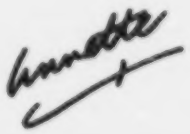
After more than two years as the writer-editor of the Public Affairs Office for the Southern Region of the Federal Aviation Administration, I transferred to the U. S. Coast Guard Headquarters when named **Engineer's Digest** editor in the Office of Engineering. I replace LCDR John Murphy, who transferred to Support Center New York.

Although relatively new to the Coast Guard, rest assured, that I will continue to put out a top quality **Digest**, since it is my top priority.

To keep the **Digest** the best publication of its kind, please continue to send your articles, comments, ideas and suggestions to me.

I wanted this job, and I am looking forward to it; but, I also realize that I cannot do it alone. I need your help.

While making your goals, plans, resolutions, etc. for the new year, do not forget the **Digest**, and keep the manuscripts coming!



CHIEF, OFFICE OF ENGINEERING
UNITED STATES COAST GUARD
WASHINGTON, D. C. 20590

Fellow Engineering Employees:

Approximately two years ago, I became the Chief, Office of Engineering. At the time, the Coast Guard was in a period of transition. Now, personnel and budget reductions are again forcing organizational changes. But, we have adapted to change before, and adapted well. We will do so again!

Changes also have occurred in the Office of Engineering. LCDR John Murphy, Senior Staff Assistant, transferred to Support Center New York as Industrial Manager in June 1985. I would like to take this opportunity to acknowledge LCDR Murphy's efforts in acting as the **Engineer's Digest** Editor for a year after the incumbent transferred.

Because of a hiring freeze, we were unable to recruit a new full-time Editor until September 1985. I would like to introduce our new Editor, Ms. Annette Nieves. Ms. Nieves transferred from the Federal Aviation Administration, Southern Region, where she was the Writer-Editor in the Public Affairs Office.

Due to the gap between LCDR Murphy's departure and Ms. Nieves' arrival, and the requirements in our printing contract, we were forced to combine the Fall 1985 and Winter 1986 **Engineer's Digest** issues. We apologize for any inconvenience this may have caused.

As many of you know, National Engineers Week will be held from 16 February through 22 February 1986. I encourage you to initiate and participate in engineering-related activities during this week.

One way to participate in these activities on a full-time basis is through membership in one or more of the many professional engineering societies. I encourage each engineering employee to become a member of one of the following professional organizations: Society of American Military Engineers (**SAME**); American Society of Civil Engineers (**ASCE**); National Society of Professional Engineers (**NSPE**); American Society of Naval Engineers (**ASNE**); Society of Naval Architects and Marine Engineers (**SNAME**); Institute of Electrical and Electronics Engineers (**IEEE**); American Institute of Architects (**AIA**); American Society of Mechanical Engineers (**ASME**), and American Society of Heating, Refrigeration and Air Conditioning Engineers (**ASHRAE**). For addresses of these societies, see page four.

Lastly, the Coast Guard Engineer of the Year will be announced in January 1986. Our Engineer of the Year also will be nominated for the Federal Engineer of the Year Award.

I appreciate your continued support throughout the past year. Best wishes for 1986!

K. G. WIMAN
Rear Admiral

Engineering News

RADM Wiman Assumes Presidency of SAME

RADM Kenneth G. Wiman, Chief, Office of Engineering, assumed the presidency of the Society of American Military Engineers (SAME) in May 1985 for a one-year term. SAME is a nonprofit corporate, professional engineering association whose goal is to increase the engineering potential of the United States for the security and strength of the nation.

Dedicated to the national defense, the Society was founded, following World War I, to provide a vehicle for military and civilian engineers to better understand our nation's major engineering challenges, and to keep abreast of the latest military engineering applications and techniques.

Since the late sixties, productivity in construction has been declining at a rate many industry readers find appalling. By common consensus and every available measure, the United States no longer gets its money's worth in construction, the nation's largest industry. For the last 20 years, construction has been the only industry with consistently negative productivity growth—dropping 3 percent to 8 percent per year. This creeping erosion of construction efficiency affects the entire U.S. economy. The price for every factory, office building, hotel or power plant that is built affects the price that must be charged for the goods and services produced in or by it.

With this in mind, RADM Wiman has chosen as the Society's theme for this year, "Helping Our Nation Get More Construction for the Money." Major issues to be addressed in pursuing this theme are: increasing construction productivity; improving engineering leadership and management; improving the quality of planning, design and construction; increasing the utilization of automation and electronics; and, promoting continued engineering education and professional registration.

Today, SAME has a membership of over 27,000 throughout the world with 123 local chapters (called posts) in major cities in the United States and abroad. The membership is comprised of approximately 21,000 civilian engineers, 5,000 officers of the Armed Forces and some 1,000 engineering students.

Rear Admiral Kenneth G. Wiman, President of SAME.

Professional Engineering Societies

SAME – **Society of American Military Engineers**
P.O. Box 180
Alexandria, Virginia 22313-0180

ASCE – **American Society of Civil Engineers**
345 East 47th Street
New York, New York 10017

NSPE – **National Society of Professional Engineers**
1420 King Street
Alexandria, Virginia 22314

ASNE – **American Society of Naval Engineers**
1452 Duke Street
Alexandria, Virginia 22314

SNAME – **Society of Naval Architects and Marine Engineers**
1 World Trade Center
Suite 1369
New York, New York 10048

IEEE – **Institute of Electrical and Electronics Engineers**
345 East 47th Street
New York, New York 10017

AIA – **American Institute of Architects**
1735 New York Avenue, N.W.
Washington, D.C. 20006

ASME – **American Society of Mechanical Engineers**
United Engineering Center
345 East 47th Street
New York, New York 10017

ASHRAE – **American Society of Heating, Refrigeration and Air Conditioning Engineers**
1791 Tellie Circle, N.E.
Atlanta, Georgia 30329

How Can I Recognize My Super Performers?

What makes people "run"? What turns them on? These are the questions most frequently asked by management. Knowing the answers to these questions is a key part in effective management of human resources. Incentives provide motivation to do what is required, and do it effectively. Both financial and nonfinancial incentives are critical parts of any organized effort to achieve and maintain a high level of productivity. Incentives are not designed to get hardworking individuals to work harder. Their objective is to induce individuals to extend proper and reasonable effort. Properly structured incentives both financial and nonfinancial, motivate people to work smarter.

Good supervisors always recognize good work. Almost any experienced supervisor will agree that this is a good principle. He will also tell you that such recognition should be as public as possible. People like to feel appreciated, and they will work all the harder and smarter when their efforts are noticed and commended. Opinion surveys continue to indicate clearly that lack of ready recognition of good work is a characteristic of poor supervision. However, it is not necessarily true that the more awards there are, the better the supervision. But, it does seem true that telling people or writing people about their well done jobs is a basic management technique. The question is: "What is the best way to put this principle into effective and reasonable operation?"

People are sensitive to what is expected. Generally speaking, the organizations that expect high performance have better than average employee effectiveness. Expectation of excellence encourages excellence. Such a climate tends to be self-reinforcing. Excellence creates pride and confidence, which encourages further striving for excellence.

The Awards and Medals Program of the Society of American Military Engineers (SAME) has as its basic objective the advancement and development of the engineering profession by emphasizing and recognizing exceptionally meritorious achievements and outstanding performances. These are nonfinancial incentives. Effective use of these awards requires consideration of the nature of contribution and the needs and interests of individuals. It is more appropriate to grant an honor (nonfinancial) award to an individual for long and distinguished service, for an excellent product or completing a complex assignment. The Society's award program however, depends on individual supervisors who need to take time to become familiar with what types of awards are available, and their interest in building and maintaining a highly motivated and productive organization.

The Society presently has 27 national medals and awards; twenty-four are presented annually. They are categorized as follows:

- *Society Service Awards.*
- *Engineer Achievement Awards.*
- *Technical Writing Awards.*
- *Education Awards.*
- *Service Related Awards—*
  a. Air Force Awards.
  b. Army Awards.
  c. Coast Guard Awards.
  d. Navy Awards.
  e. National Ocean Service Awards.

The SAME Awards and Medals Program provides supervisors with the opportunity to recognize super performers, individuals, or groups, and to help build morale.

For more information about the SAME Awards and Medals Program, contact Mr. Jacob Patnaik, Chairman, SAME Medals and Awards Committee, at FTS 426-1314.

Civil Engineering Training

The sixth annual Civil Engineering Management Training Course was held from 23 to 25 April at Coast Guard Headquarters. The course, as in previous years, was for those individuals recently assigned/transferred as new assistant branch chiefs, facilities engineering officers or technical assistants. Various topics were included so as to provide a broad overview and synopsis of civil engineering functions and responsibilities. A partial listing of these topics included: Civil Engineering Management System, Shore Facility Planning, Design Policy and Standards, Project Documentation/Structalts, Vehicles/Energy, and the Civil Engineering Data System (CEDS). The course provided an opportunity to expose the attendees to civil engineering management in an atmosphere where the daily work environment did not interfere with the effective training.

New G-ECV Division Chief

On June 17, CAPT Robert J. Swain assumed the duties as Chief, Civil Engineering Division. CAPT Swain comes to Headquarters from the Fifth Coast Guard District where he served as Chief, Engineering Division. A 1961 graduate of the Coast Guard Academy, he obtained a B.S.C.E. in 1967 from the University of Illinois. CAPT Swain has served in a wide variety of operational and engineering billets. His past operational billets include USCGC *Comanche*, USCGC *Cape Jellison* (CO), LORAN Station Nomaike Japan (CO) and USCGC *Dauntless* (XO). Civil engineering duty in the 12th, 7th and 5th districts was followed by assignments as Facilities Engineer at SUPRTCEN Kodiak, and Branch Chief at CGD9 (ecv) and CGD5 (ecv). CAPT Swain is active in the Society of American Military Engineers (SAME), and is currently serving as Vice President of its local Washington, D.C. post.

Fellowship for Engineers in Management Available

The Professional Engineers in Government (PEG) practice division of the National Society of Professional Engineers (NSPE) announces the availability of a $1,000 Fellowship to be awarded to an engineer pursuing advanced studies in management. The grant will be administered by NSPE's Educational Foundation, which oversees a million-dollar-a-year engineering scholarship and grant program, the largest of its kind in the U.S.

PEG is funding the Fellowship in response to a concern that practicing engineers were being overlooked for promotion to management positions owing to the lack of formal credentials. Any Engineer-in-Training (EIT) or registered Professional Engineer (PE) from any discipline employed in any area of engineering practice (Government, Education, Private Practice, Industry or Construction) may apply.
Other qualifications for application include a minimum overall Grade Point Average of 3.0; a desire to earn an MBA in Management, Masters in Engineering Management or Masters in Public Administration; and acceptance into a program accredited by the American Assembly of Collegiate Scholars of Business or the Accreditation Board for Engineering and Technology.

For further information and application forms, contact the NSPE Educational Foundation Professional Engineers in Government Management Study Fellowship, 1420 King Street, Alexandria, Virginia 22314. All applications must be received no later than *February 14, 1986*.

378' FRAM

FRAM contracts were awarded on 17 June 1985. The East Coast winner is Bath Iron Works (BIW) of Bath, Maine, and the West Coast winner is Todd Pacific Shipyards of Seattle, Washington. Thirty man RIO's will be established at each contractor's shipyard.

Tacoma Boatbuilding Company (TBC), in association with Boston Shipyard Corporation, filed for and was awarded a Temporary Restraining Order (TRO) by the U.S. District Court, Western District of Washington. The result of the TRO was to stop work at both shipyards until the problem was resolved. Subsequently, Southwest Marine Shipyard filed a protest to GAO related to the West Coast contract to Todd Shipyards. The Coast Guard has been providing information, as appropriate, to have the TRO removed.

All personnel assigned to the RIO's have been placed in an unfortunate, but necessary, "holding pattern". The length of the delay is not known at this time. The Coast Guard will have to evaluate the impact of scheduling people and cutters as a result of these protests.

FLASH.... 10 July.... The protest issued by TBC has been overturned. Todd and Bath can now get back to work.

1985–86
Fellowship For
Engineers In
Management ....

IS NOW AVAILABLE
$1,000
FOR A GOVERNMENT ENGINEER
FOR MANAGEMENT STUDIES
DEADLINE: FEBRUARY 14, 1986

Winners of '85 Chesapeake Design Competition

A team from the U.S. Coast Guard Academy has won the Dr. James A. Lisnyk Award and a $500 cash prize for the best design in the 1985 SNAME Chesapeake Section Design Competition. The team was made up of 1985 seniors:

ENS Douglas J. Henke
CGC *Diligence*

ENS Charles W. Mello
CGC *Courageous*

ENS Charles D. Michel
CGC *Decisive*

ENS Michael J. Roer
CGC *Vigilant*

ENS Peter J. Coxon
CGC *Valiant*

ENS Thomas A. Stanek
CGC *Jarvis*

ENS Paul F. Thomas
CGC *Blackhaw*

ENS Carl B. Frank
CGC *Diligence*

The team's Faculty Advisor was LT John G. Tuttle, Senior Design Course Instructor.

Six designs, representing institutions such as the U.S. Naval Academy, the Massachusetts Institute of Technology, and Virginia Polytechnic Institute and State University, were submitted.

Conducted annually by the Chesapeake Section, the Design Competition is open to undergraduate student members of the Society. This year's subject was a small, multimission helicopter carrier for use on offshore and coastal waters. Each of the submitted designs was prepared according to an established Circular of Requirements. The Circular required a small, fast platform for two LAMPS helicopters. It also required a sustained speed of 25 knots in sea state 5.

The winning team developed their version of a craft whose mission profile included: ASW search, investigation and prosecution of submarine contacts; minehunting; search and rescue; and coastal patrol against fishing and customs violators. The result was a 340 feet long monohull with the following features:

Length overall	368 ft.
Waterline	340 ft.
Beam	42.5 ft.
Draft	10.5 ft.
Depth	26.0 ft.
Max speed	35 knots
Cruise speed	12 knots
Range	3,000 nm.
Displacement	1,723 lt.
Installed power	40,000 shp.
Propulsion plant—	
Gear gas turbine (2)	
AC rectified diesel electric	
Fixed pitch propellers (2)	
Hull material	H.S. steel
Crew size	92

The award was presented at the Chesapeake Section Technical Meeting, Crystal City, Va., on September 18, 1985. It was received by the U.S. Coast Guard Faculty on behalf of the team members who could not attend due to assignments.

Although they faced stiff competition from other outstanding universities, their technical and professional capabilities resulted in a well-deserved recognition. Congratulations to these team members, whose design met stringent criteria, and was selected as the best.

Chesapeake award presentation, September 18/85 (recipients from left): CDR W. E. Colburn, Chief, Marine and Ocean Engineering Section; LCDR E. M. Brown, Instructor, Marine and Ocean Engineering Section; and LT J. G. Tuttle (Design Team Advisor), Instructor, Marine and Ocean Engineering Section; (presentors from left): Mrs. Bridget Lisnyk; Mr. Robert Keane, Chairman, Awards Committee; and Mr. Amos Baki, Chairman, SNAME Chesapeake Section.

Lister Engine Fuel Lift Pumps

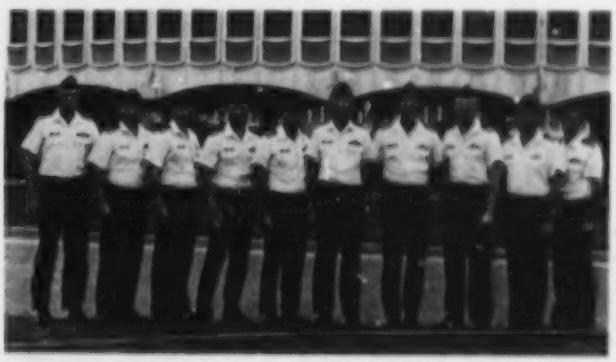
Commandant (G-EOE-3) recently received a report from one automated lighthouse maintenance unit which stated they had to replace 15 fuel lift pumps on their Lister diesel engines. This is the first that Commandant (G-EOE-3) has heard of such a high failure rate. In order for us to determine the magnitude of the problem and what remedies are required, districts and field maintenance personnel are invited to advise us about any similar experiences. The point of contact is LT Barrett at FTS 426-1106.

Aircraft Maintenance Officer Training

On 13 June 1985, 10 officers began their one-year Aircraft Maintenance Officer Training Program with an indoctrination visit to USCG Headquarters and AR&SC Elizabeth City, N.C. Upon completion of their training, these officers will be designated Aircraft Maintenance Officers, and assigned to the engineering section of an air unit.

This program consists of on-the-job and resident training at Coast Guard, Air Force and civilian schools, and is designed to provide the information necessary to efficiently manage a unit's engineering department. Mandatory courses include Nondestructive Inspection Theory, Corrosion Control, Jet Engine Accident Investigation, Aviation Administration, and Junior Officer Leadership and Management. On-the-job training involves completing a syllabus while performing a variety of collateral duties under the supervision of the unit's engineering officer.

The Aeronautical Engineering Division sponsors between 10 to 15 officers per year for this program. Officers interested in this training should refer to COMDTINST 1500.10A.



Aircraft Maintenance Officer Students for 1985 (from left to right): Lt Jake Korn, Lt Charles Holman, LT Steve Lawrence, LT Andy Moynahan, LT Glen Gorton, LT Dan Cutrer, LT Roger Gayman, LTJG Mike Neusel, LTJG Phil Bray and LT Doug Daeffler.

SWATH Demonstration and Evaluation Cutter

The Contract Design for the SWATH cutter is complete. This includes the specifications, several contract drawings and other guidance drawings. The Contract Design SWATH has the following characteristics: LOA-138'; Beam-60'; Draft-14.5'; Displacement-600 LTons; and Crew-35, including 5 person AVDET. It is all aluminum, helicopter capable, and its propulsion includes diesel vertical reduction to controllable pitch propellers. The design speed is 20 knots. The SWATH is designed for unlimited, multimission operations in sea state 5, and will carry two rigid hull inflatables with single point davits; a sophisticated command, control and communication suite; state-of-the-art firefighting equipment; and an automated control and monitoring system. It will be equipped with fins to further reduce motions from its already excellent ride characteristics.

The SWATH acquisition is presently awaiting approval by the Office of the Secretary of Transportation. Upon approval, a contract for detail design and construction will be pursued.

Replacement Polar Icebreaker

Conceptual Design of the Replacement Polar Icebreakers is proceeding on schedule. A response to the Acquisition Paper has been drafted by the Department; it is anticipated that approval will be granted for the Coast Guard to proceed through the Contract Design phase. The results of a preliminary manning study have been forwarded to G-O for review, and a preliminary maintenance philosophy has been developed. An independent study of the availability of foreign icebreaker designs has been completed, and confirms the Coast Guard's opinion that there are no existing designs available that would meet the sponsor's requirements.

Model tests, to determine the horsepower requirements of four generic conceptual hull designs, have been completed, and compare well with the results from a computer model. Clarification of the details of the sponsor's requirements continues, and the results are being incorporated into the design. Two candidate hull arrangements are being examined at this stage of Conceptual Design. The displacement of the candidate hulls ranges from approximately 12,700 tons to roughly 14,300 tons. The optimum hull candidate was selected and presented to the sponsor for approval prior to the start of Preliminary Design in October 1985.

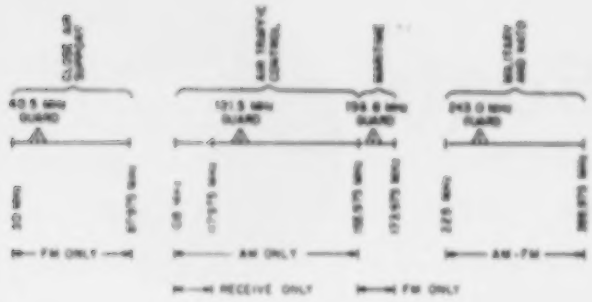
New Rotating Optic

The Ocean Engineering Division has tested and approved a new rotating optic, the FA-251-AC. This optic is primarily intended as a replacement for the DCB10. The FA-251-AC provides improved operational capabilities, but consumes only one-third of the power of the DCB10.

The FA-251-AC is equipped with the CG-4P-120 lampchanger and 150W tungsten-halogen lamp. Features of this lens/lamp combination are:

- *Five rotation rates.*
- *Nominal ranges—*
  14–17 nm. clear lens.
  11–15 nm. red or green lens.
- *Variable flash characteristics.*
- *Apperent flash lengths—*
  .03–.20 seconds.
- *A unique overhead direct drive motor replaces the friction drive assembly found in the Amerace 2130 (DC 190 mm.)*
- *Forced air cooling.*
- *Daylight controlled.*

Twenty FA-251-AC's are in service throughout the Coast Guard. Field testing is in progress on six of these optics which are experimentally equipped with a single 175W metal-halide lamp. This lamp increases the nominal range of the FA-251-AC to 19 nm. Approval of the 175W metal-halide lamp awaits verification of life and reliability standards.



Radio frequency range

Airborne Multimode Radio

We have recently signed a 1.4 million-dollar contract for 50, of the more than 400, AN/ARC-182 multimode radios scheduled for the Coast Guard aviation inventory. These radios are funded by the Navy, and are being installed in the new HH-65A *Dolphin*, the HC-130H *Hercules*, and eventually, in the HH-3F *Pelican* aircraft.

The radio has a frequency range of 30 to 399.975 Mhz on any of 11,960 channels, covering the UHF and VHF frequency bands in the AM and FM modulation modes, as shown in the diagram. It has a demonstrated mean time between failure (MTBF) rate of more than 500 hours, and a reliable built-in-test (BIT) for unit level repair to the board level.

A Job Aid has been developed at ATTC Elizabeth City to cover unit level maintenance, and is being tested at this time. After Job Aid testing and the procurement of spare modules is complete, the Job Aid will be distributed to the field units. In the interim, the AN/ARC-182 will be fault verified with the BIT, and returned to AR&SC for repair.

Component Standards Manual

The Design Policy Section (G-ECV-2) of the Civil Engineering Division is currently developing square feet criteria for 12 major functional components that are found in all shore facilities; including among others, administration, berthing, dining, shops and training. After sizing criteria is completed for 12 functional components (late next year), the Design Policy Section will develop individual space criteria for areas such as avionics shops and communication centers with unique technical requirements. The information developed will be published in a new manual called the Component Standards Manual. The first section, Square Feet Criteria for Administrative Spaces, will be distributed as a Commandant Instruction as soon as the review process is completed. A binder will be provided with the release of additional sections of the manual.

2000th Aid to Navigation Converted to Solar Power

Aids to navigation units continue to make the solar power conversion project a success, and have converted over 2,000 aids to solar power. Field units are requesting additional equipment to convert more aids to solar power; and thus, avoid the expense and disposal problems associated with primary batteries. Additional equipment requests increased the number of aids originally scheduled for conversion during FY 85 by over 40 percent.

Voltage regulators have been the primary cause of the few discrepancies noted on solar powered aids. After some investigation and research, Commandant (G-EOE) determined that the voltage regulator could be eliminated from the charging system by modifying the solar panel, and using standard daylight controls. The solar panel contract was modified to include blocking diodes, and the first panels equipped with diodes were received in May. A contract for blocking diode field change kits was established and these kits, which allow field units to install diodes in unmodified panels, were distributed in August. In addition, unmodified panels, stored at Supply Center Brooklyn, will have diodes installed in them before delivery to field units. These changes will simplify installation and troubleshooting procedures, as well as significantly reduce the percentage of discrepancies of solar powered aids.

Solar powered aid

Patrol Boats

a symposium

MARCH 13 – 14, 1986

Crystal City Sheraton
Alexandria, Virginia

The Flagship Section of the American Society of Naval Engineers and the U.S. Coast Guard are pleased to announce a symposium on Patrol Boats in March 1986. The meeting is planned to provide a professional forum addressing Patrol Boat design, construction, maintenance, combat systems, and operational issues.

Capt. G. H. Moritz, USCG (Ret.)
Symposium Chairman

For more information:

Capt. Richard A. Walsh, USCG
Technical Director
(202) 426-1220

Cdr. David E. Prosser, USCG
Director of Operations
(202) 426-1159

USCGC Farallon (WPB 1301) under way for sea trials in the Gulf of Mexico.

Shafting Modifications to CGC Bramble (WLB 392)

LCDR P. J. Stager
Naval Engineering Branch
Ninth Coast Guard District
Cleveland, Ohio

LT R. W. Danahy
NA&ME Program
University of Michigan
Ann Arbor, Michigan

Introduction

In 1980 and 1981, several Ninth District 180' WLB's suffered a series of shaft bearing and seal failures. Repairs were complicated by a lack of replacement parts at SICP and poor quality assurance by part suppliers.

Local tradition held that Ninth District WLB's have always had more bearing and seal problems than other WLB's because "ours break ice and others do not". However, CGC *Ironwood* had just gone through six thrust bearings, in short order, before the seventh proved reliable. CGC *Plaintree* had just "beat hers to death" in a Pacific storm.

A check through the archives showed that bearing and seal failures were indeed a problem in the Ninth District. See Table 1 which includes only drydockings. Numerous waterborne changeouts are not shown.

CCGD9 was recently authorized a five-year drydock cycle. With this kind of a track record on seals and bearing failures, the economics of the five-year drydock cycle would never be realized. A little math quickly shows that CGC *Mariposa* has been drydocked on an average of once every nine months since 1953.

Table 1, however shows that CGC *Sundew* has never had an emergency drydocking for shaft seal or bearing problems. In 1953, *Sundew*'s main propulsion plant was upgraded to 1800 hp. by installing Cooper Bessemer GSB-8 engines. The main motor received a new armature shaft which had a World War II surplus Kingsbury submarine thrust bearing at the forward end. A conventional water lubricated stave type shaft bearing was installed aft. No more roller bearings; no more oil seals; and no more failures.

Working with a local shipyard, a rough cost estimate of $200 K. was developed for a similar type conversion on a 180' WLB. A quick economic analysis showed that for $2.5 K. per year per ship, instead of the "Do nothing" alternative, we could have a much more reliable WLB. Both operators and engineers agreed that $2.5 K. was cheap insurance for a reliable propulsion system.

Commandant (G-ENE) was formally advised of the chronic bearing and seal problems, and of our proposed solution shown in figure 1.

Summary of 180' WLB Emergency Drydockings

Acacia (Four Emergency Drydockings)

Year	Fwd Seal	Aft Seal	Aft Bearing	Thrust Bearing
74	X	X		
78		X		
80		X	X	
82		X		
Total:	**1**	**4**	**1**	**0**

Bramble (Nine Emergency Drydockings)

Year	Fwd Seal	Aft Seal	Aft Bearing	Thrust Bearing
70	X	X		X
71	X	X		
72	X	X	X	X
73		X	X	X
75	X	X		X
76		X		
81	X	X		X
81			X	X
82		X		
Total:	**5**	**8**	**3**	**6**

Mariposa (Fifteen Emergency Drydockings)

Year	Fwd Seal	Aft Seal	Aft Bearing	Thrust Bearing
62			X	X
64		X		
66	X	X	X	X
67	X	X		
69	X	X		
71		X	X	
72		X		
75		X		
76		X		
76		X		
77		X		
77		X		
78		X		
79		X		
82	X	X		X
Total:	**4**	**14**	**3**	**3**

Mesquite (Fifteen Emergency Drydockings)

Year	Fwd Seal	Aft Seal	Aft Bearing	Thrust Bearing
72	X	X	X	X
78	X	X		
80	X	X	X	X
Total:	**3**	**3**	**2**	**2**

Sundew (No Emergency Drydockings for Seals or Bearings)

Table 1

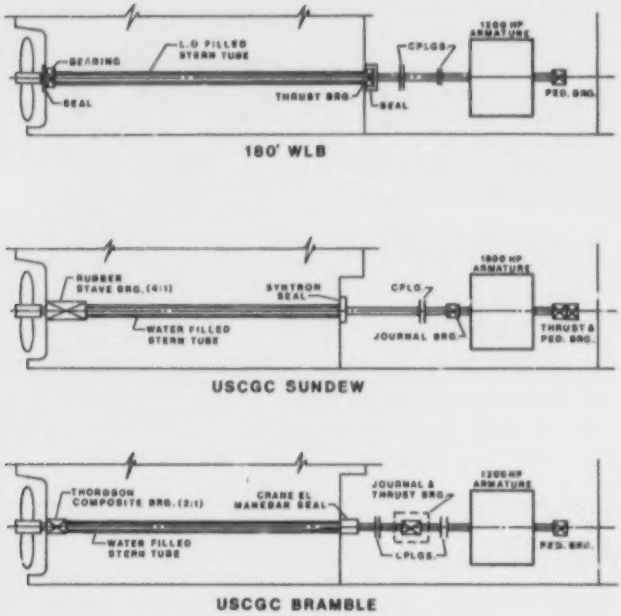


Figure 1. 180' WLB arrangements of shafting.

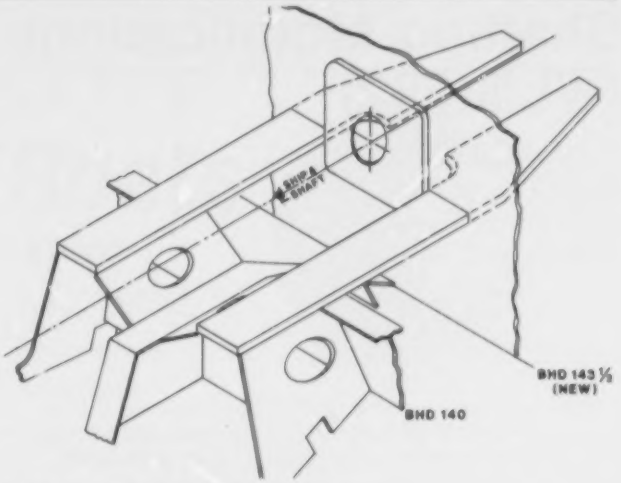


Figure 2. New journal and thrust bearing foundation.

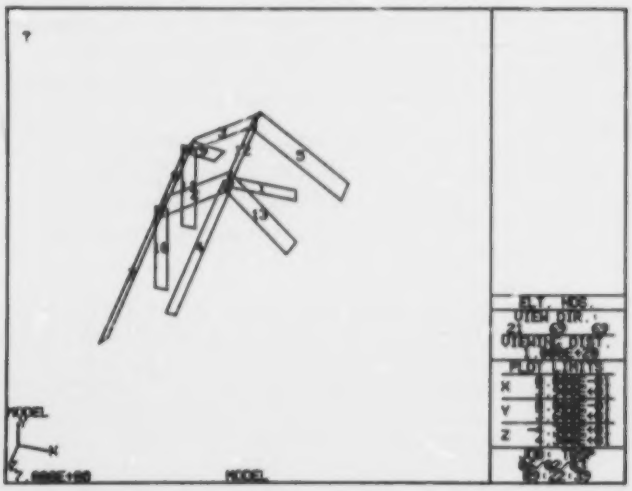


Figure 3. Computer analysis.

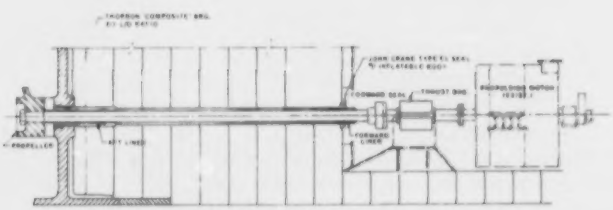


Figure 4. Arrangement of shafting.

Important Design Features

- *A water lubricated stern tube bearing of Thordon "Composit" in a 2:1 ratio, vice the more conventional 4:1 length/diameter ratio.* Thordon "Composit" was chosen due to its superior wear characteristics in dirty water. A 2:1 l/d ratio was used due to the high acceptable bearing pressures of the Thordon when compared to rubber, micarta or lignum vitae staves. Nevertheless, the bearing housing and shaft liner were designed to accommodate a conventional 4:1 stave type bearing in case unforeseen problems developed.

- *A John Crane type "EL" Manebar seal for the stern tube.*

- *A Waukesha combination journal thrust bearing.* This bearing is rated for a 30,000 lb. thrust load and 10,000 lb. radial load. The bearing is located approximately where the old coupling piece was. By locating the bearing here, the main motor would remain undisturbed. A small extension of the motor room into C-1-W accommodated the extra room needed for the shaft seal and bearing.

- *A STIFF bearing foundation.* An in-house design was developed using technical and computer services provided by CCGD9 (mmt). The bearing foundation was thoroughly analyzed statically using the GIFTS 5 finite element analysis program. Figure 2 is a guidance sketch of the foundation; figure 3 is what the computer analyzed; and figure 4 is an as-built print of the entire shaft system.

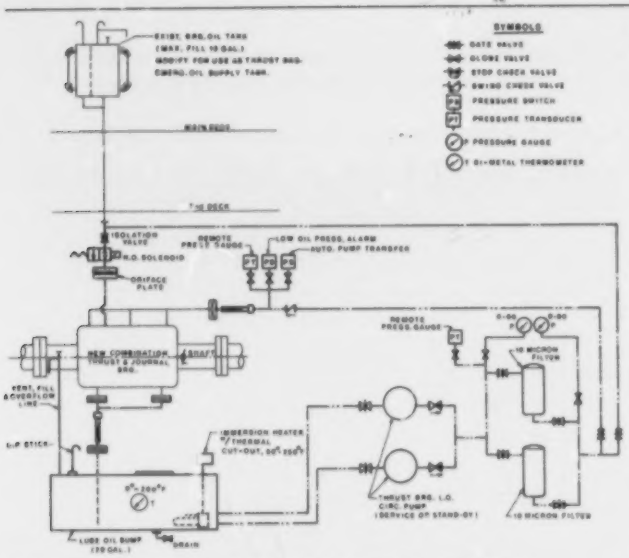


Figure 5. Diagram of lube oil system for combination thrust and journal bearing.

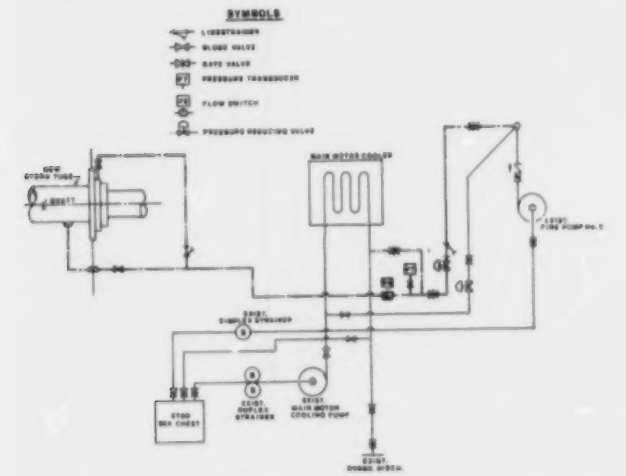
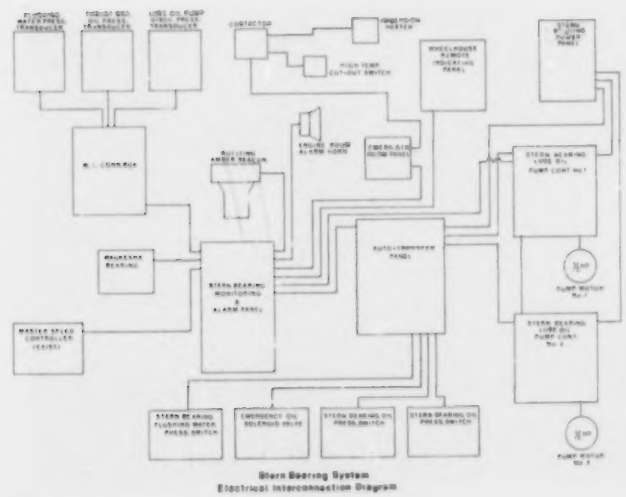


Figure 6. Diagram of cooling water system for new stern bearing and seal.


CONTACTOR
HIGH TEMP CUT-OUT SWITCH
WHEELHOUSE REMOTE INDICATING PANEL
ENGINE ROOM ALARM HORN
STERN BEARING MONITORING & ALARM PANEL
AUTO-UNDERWAY PANEL
STERN BEARING LUBE OIL PUMP CONT. NO. 1
STERN BEARING LUBE OIL PUMP CONT. NO. 2
PUMP MOTOR NO. 1
PUMP MOTOR NO. 2
STERN BEARING FLUSHING WATER PRESS. SWITCH
EMERGENCY OIL SOLENOID VALVE
STERN BEARING OIL PRESS. SWITCH
STERN BEARING OIL PRESS. SWITCH

Stern Bearing System
Electrical Interconnection Diagram

Figure 7. Stern bearing system electrical interconnection diagram.

- *A new lube oil system.* Shown schematically in figure 5.
- *A modified raw water system for seal cooling and stern tube flushing.* Shown schematically in figure 6.
- *A control and monitoring system for watchstanders.* Shown schematically in figure 7.

Commandant was advised of the more detailed proposal. The staff approved the idea, and provided the OG-45 funding. CGC *Bramble* was chosen to receive the modifications since its routine drydocking was scheduled for the Summer of 1983.

The modifications were accomplished by the AmShip Division of the American Shipbuilding Co., Lorain, Ohio. Working drawings and as-built drawings were developed by the contractor. Underway trials were held on 3 November 1983, and that evening, the shipyard closed down for good. The total cost of the modification was approximately $180 K., including Government furnished equipment, but excluding drydocking costs. Table 2 provides more information. Photographs on pages 14 and 15 the end product.

Summary of Costs for CGC Bramble T/B Mods

D-3	*$140,096*		*Original Contract Item*
A-Forms:			
A– 1	N/C		Additional John Crane Seal Info
A– 2	2,222		Provide John Crane Seal Tech Rep
A–10	(251)	Credit	Mods to T/B Installation
A–11	850		Mods to L/O Piping
A–18	N/C		Check Shaft, Delete Cold Roll, Crate up Parts
A–21	486		Fab. Key for Prop
A–22	N/C		Bore out 11" ID Rudder Skeg Hole for Shaft
A–23	1,500		Install Gov. Furn. 440V Power Panel
A–24	450		Mach. Prop Shaft Coupling to Fit Taper
A–28	1,215		Fab. New S/S Flange for Prop Hub
A–29	N/C		Delete S/B Req. for C-1-W & C-301-V
A–34	1,920		Fab. T/B-Main Motor Coupling Bolts
Services:			
	1,382		1/3 Temporary Services
	5,000		1/3 Drydocking Costs
Government Furnished Material:			
	28,378		Waukesha T/B with spares
	1,703		440V Power Panel
Total:	**$184,951**		

Table 2.

New System Advantages

- *Reliability.* If we can rely on *Bramble*'s initial success and 30 years of *Sundew* experience, emergency drydockings for propulsion shaft bearing and seal failures are soon to become a bad memory. A check of the wear rate of the Thordon bearing shows a wear of 0.026 inches for the first year. This equates to a 6.5-year bearing life; however, the wear rate after the initial break-in should be considerably less.

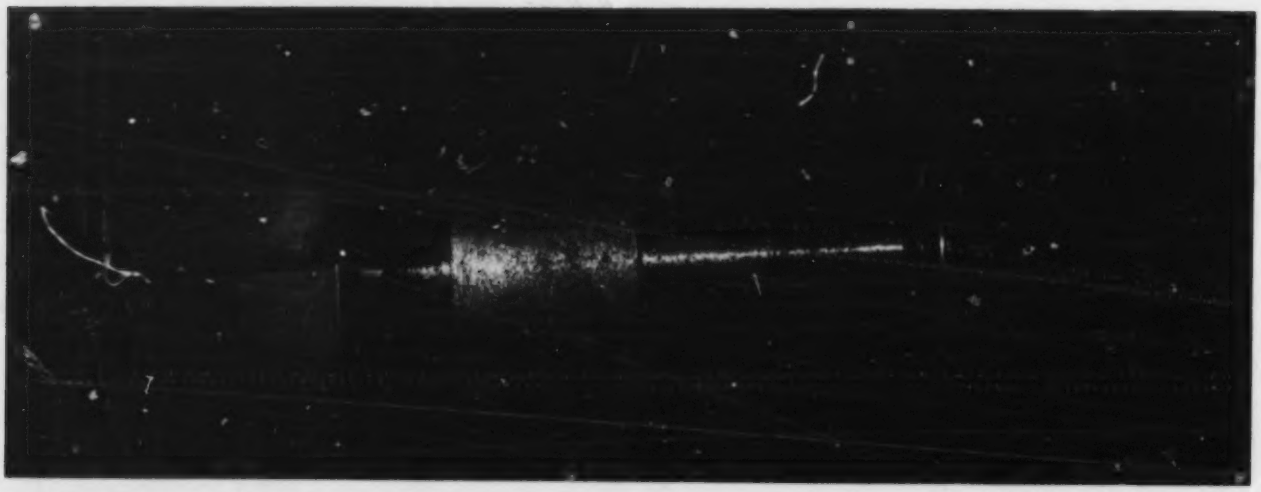
- *No oil.* Since the stern tube is now oil free, no oil can escape when a stern seal fails. Although 4065 (blown rapeseed oil), as used in other WLB's, may be biodegradable, try telling that to an irate environmentalist or boat owner.

- *Supportability.* No longer are we tied to two long lead time manufacturers for bearing and seal support.

- *Maintainability.* No special shipyard skills are required. Those of you, who have had to educate the hammer mechanics at "Louie's Low Bid Bycicle Shop and Drydock", can appreciate this.

Conclusion

CGC *Bramble* has since completed the Winter '83 buoy decomissioning; '84 buoy commissioning and decommissioning; '85 commissioning seasons; and has operated over 250 hours in all types of lake ice. Due to the unqualified success of these alterations, the Ninth District received approval to modify another tender during FY 1985.



Looking down from the port side of the motor room's upper level. FWD is to the left, and AFT is to the right.

Looking AFT from atop the main motor.

Close-up of the Waukesha journal/thrust bearing, facing AFT.

Close-up of the John Crane type "El" Manebar seal, port side facing AFT. The line entering the top of the seal is for flushing water. The line from the port side of the seal is for the inflatable boot.

About the Author

LCDR Stager is Chief, Naval Engineering Branch, Ninth Coast Guard District. He has served as Engineer Officer on CGC *Glacier* and CGC *Ingham*, at Greater Antilles Section, and a variety of engineering billets ashore and afloat.

LT Danahy is attending the NA&ME Program, University of Michigan. He has served as the WLB Maintenance Coordinator for the Ninth Coast Guard District. LT Danahy previously served on CGC *Northwind*, and is a 1980 graduate of the Coast Guard Academy.

Chief Engineer's Comments

The article describes a solution to the 180′ WLB shafting problem. This shafting modification has been authorized for two Ninth District cutters; however, cost of the modification is prohibitive for installation on all 180′ WLB's. A multi-lip seal modification was made to the shaft system, which has been free of seal and bearing failures, since installation on CGC *Hornbeam*, approximately six years ago. CGC *Hornbeam*'s modification is considerably more cost effective than the modification to CGC *Bramble*. A ShipAlt is being developed for multi-lip type seal modifications to shaft systems of the remaining 180's.

New Ways to Control Your Projects; CPM Is Coming of Age for Engineering Activities

Gerald B. O'Hara
Facilities Design and Construction Center
(West) Seattle, Washington

A New Role for Coast Guard Civil Engineers

How in the world do you manage a dozen or so major shore facility construction projects scattered throughout the West Coast, Alaska and Hawaii from an office in the Federal Building in Seattle, Washington? Good question. Especially if you count the support you have available. In my case, it's a total of four engineers, plus four inspectors and an indispensable do-it-all secretary. Seems kind of hopeless.

Yet construction management is just one of the missions of the newly established Facilities Design and Construction Center (FD&CC) regional offices. Commandant has split the world in two—East and West, and we've gathered together an impressive staff of professional engineers, architects and technicians to execute a multi million dollar workload.

In reality, we are a Management Information Center. Through state-of-the-art electronics, special contract requirements and, with the willing support of contractors, private AE firms and commercial inspectors, we've become the terminus of a system that provides daily information on all our jobs. Through feedback loops, check and balance procedures, and continuous on-line communications, decisions can be made in a timely manner to keep large construction contracts on schedule and within budget.

The key to success, in this most challenging of jobs, is innovation. Don't throw the old book out—set it aside, and rethink your procedures, techniques, equipment and human resources. Take a good look at private contractors, and see what the successful ones are doing. Find out what you can really do, and take steps to do it well.

One of the major management tools that we are using is the Network Analysis system (NAS). This is the Government's name for that old stand-by, the Critical Path Method (CPM) in construction management.

Briefly, NAS is a well-defined system of planning and scheduling work. NAS is nothing new. It was developed specifically for the planning of construction in the 1950's, and has proven to be an effective cost saving technique on large-scale Government and private industry projects.

The main emphasis of this article is to acquaint the reader with a new, unique reason to use NAS as the foundation for construction management.

Other Engineering Disciplines

NAS, in some form, works for all engineering disciplines. Project size and type does not cancel out the potential benefits. Whether you're involved in aircraft, or ships or construction, NAS applies. Whether you're interested in planning, predesign, design, manufacturing or construction, NAS also applies. NAS could, and should, be used for selected small projects. It's easy to simplify, and becomes very workable for just about anything that needs some coordination and control.

Why NAS?

Sooner or later, every construction contractor or owner becomes involved in projects that challenge his management abilities. An owner or contractor is often at a loss to keep pace and maintain direction due to project size or complexity; infinite varieties of materials to be ordered; hundreds of shop drawings to be coordinated; dozens of subcontractors to be integrated; the arrival of equipment and labor sequenced to minimize cost and maximize productivity; and cash flow problems.

Usually the responsibility for making the management decisions rests with several key people, but how do they make the decisions? How can they keep track of the many details involving any construction project? An oversight or miscalculation can cost many dollars, and delay the whole project with resultant financial disaster.

Getting the project completed on time is of great importance to the Government. Complex relocation plans, operational commitments and other constraints are formulated based on a particular contract completion date. But delays are a common fact of construction life. Permits, labor strikes, subcontractor failure, material shortages and design changes are but a few of the variables faced daily. Any one of these can delay the project and, in some instances, shut it down altogether. NAS is our major means of controlling the impact of delays.

The Basic System

The specific requirements of our system are the familiar arrow diagram with a related mathematical analysis of activities. The diagram graphically represents the whole project, using circles and arrows. Each arrow represents an activity or unit of work; each circle an event or completion for an activity. By time-scaling and cost-loading the diagram, we immediately become aware of the most important job factors—time and money. Unlike a bar

chart, a proper NAS schedule shows the interrelationships of all activities; how each affects or impacts the others; the sequence of construction; the flow of the work; and the relationship of each activity to the overall project completion.

The mathematical analysis is a manually generated or computerized listing of the activities, and provides a tabular description of each activity; its duration; early start and early finish dates; late start and late finish dates; and a float, if any. It identifies the "critical" work (i.e., what must be done during an exact time period to meet the completion date). With several hundred activities, one can easily have a thousand target dates for an average size project. NAS ties them all together, and provides a written document for monitoring and controlling the work. When things go wrong (and they will), NAS provides cause and effect data, and the impact that problems or delays have on the overall job schedule and budget.

Until recently, NAS required mainframe computers to manage the myriad of data properly. This was too great a burden for most of our contractors, so we've set up a system that doesn't require a mainframe computer. However, with a microcomputer, our requirements become a "piece-of-cake".

For full disclosure of the entire system, call FTS 399-1697. For a copy of one of our bid packages, refer to Specification Section 01310.

Who Does What to Whom?

One important issue rarely gets mentioned on the job, but always comes up in the courts—people problems. How do we clearly explain to all parties of the contract what their job responsibilities are, and what impact their action or inaction has on the contract?

NAS does the trick. It ties all parties into one working group. If someone isn't "on the ball", their lack of cooperation is readily identified along with the damages they have caused. We all know that when problems crop up, it is never our fault—the other guy did it. Not so when you are confronted with NAS documentation.

NAS is the glue that binds contractors, designers and the Government together, resulting in a team effort rather than in individual (and often adversary) actions. *All parties contribute, review and agree to the NAS prior to on-site mobilization by the contractor.* The Preconstruction Conference is the event where all tasks and responsibilities are approved.

Is It Worth All the Fuss and Bother?

Our NAS has been designed to provide the following:

- Disciplined method to plan the work in an orderly manner.
- Contractual requirement that forces all parties to become familiar with the contract documents.
- Flexibility of updating with immediate cause and effect.
- Identification of potential problems.
- Expediting of corrective measures.
- Coordination of all personnel involved.
- Measurement of progress.
- Graphic record for planned versus actual comparisons.
- Cost control.
- Cash flow requirements.
- Equipment and work force planning.
- Claims avoidance.

This adds up to money savings for our contractors and timely online shore facilities for the Coast Guard.

Savings

We call for a cost-loaded NAS. Each activity has a cost identified with it. Add up all the activities and their associated cost, and you have the total bid price. With this information, the contractor can plot the project's cash flow requirements. By adjusting work here and there, the contractor can minimize the amount of money that must be borrowed to meet the payroll. At today's rate of interest, savings can be substantial. Also, we require each activity to be completed in 10 to 20 days. This means many activities can be billed as 100 percent complete during the normal 30-day payment intervals. We do not retain 10 percent on completed items. Once done, inspected and accepted, they are paid in full. This "no retainage" provision adds to the contractor's list of savings.

By careful planning, the contractor can maximize the use of labor, equipment and material on-site to "level resources". How many people do I put where, doing what? NAS answers these questions. Resource leveling minimizes costs and maximizes profits.

The use of claims has increased dramatically in the last 10 years as a means for the contractor "to make a buck" on each job, "come hell or high water". One of the main problems in claim reviews has been getting the parties involved to agree on what happened and what's the cost. The claims avoidance objective of our NAS is made possible by identifying potential claims and correcting a problem before it occurs.

Our system requires data input from all parties. The contractor tells us what was or wasn't done on a daily basis; what issues are causing impacts or delays; and what can be done about it. Our inspector provides data and opinions. When called on, the designer or one of our other consultants gets involved—and in a timely manner. Our goal is to resolve issues as soon as possible, and work out agreements for changes now.

Our NAS provides data to reconstruct any issue with corresponding impact factors. If a problem comes up the first day of construction, we can tell what effect it will have on the completion date. If positive, we issue a time extension now—not when the work is completed, and after many attempts by the contractor to get a justifiable extension. Proper claims must be identified and resolved in a timely manner.

The Bottom Line

So take a close look. NAS helped put men on the moon. It may be just what you need to get your job done on time, within budget, and without interrupting operational activities!

About the Author

Mr. Gerald B. O'Hara, Chief of the Construction Division, FD&CC (West), is a native of Cleveland, Ohio, and a graduate of Case Institute of Technology. After working eight years as a consulting engineer, he entered Government service with the Coast Guard. He has served as the Chief of Structures in the Ninth District and Technical Assistant in the Seventh District. Mr. O'Hara was recognized as the 1970 Oren Medal winner. He is a registered Professional Engineer in five states and a member of numerous professional societies. Mr. O'Hara's background includes 28 years of facility design and construction experience.

Chief Engineer's Comments

As this article has pointed out, Critical Path Method (CPM) is an old construction industry standby. However, CPM (or as we call it, Network Analysis System) is relatively new to the Coast Guard, and its use has come not a moment too soon.

Today's budget climate has tasked the Coast Guard to find every possible means to stretch our portion that extra mile, and one way is through tighter project control. The Network Analysis System is an excellent tool for exercising optimum project management. I recommend continued use in the FD&CC's as well as in all engineering offices throughout the field.

Thinking About Writing An Article?

Don't Hesitate!

Write It NOW

PMS Statistical Recording and Reporting for Cutter Engineering Report

MKC Timothy J. Pitts
Naval Engineering Branch
First Coast Guard District
Boston, Massachusetts

Introduction

In the past and present, there has been no formal recommendation or direction in the keeping of Preventive Maintenance System (PMS) information. I know, from experience, that some systems are not done in earnest, and the way PMS is delegated or assigned, leaves many people (particularly junior enlisteds) to manage and conduct extremely important maintenance procedures without supervision. If this system is followed closely, it will help avoid unexpected casualties because those casualties that can develop over time are likely to be caught and corrected.

This article presents a method of managing cutter PMS information; a method which I started to use aboard CGC *Iris* while I was Main Propulsion Assistant in 1982. First, I designed a form (see figure 1) which was completed monthly, recording the information necessary for the reporting requirements at the time. On the first line of the form, I recorded separately the number of monthly, quarterly, semiannual, annual and hourly MPC's recommended or scheduled for that month. On the third line, I recorded the sum of the man-hours required to do those scheduled MPC's as estimated in the PMS Manual's index. At the end of each month, I recorded the actual number of MPC's accomplished on the second line, and the actual number of man-hours used to accomplish those MPC's on the fourth line. After totalling each line, I could calculate the percentage of PMS completed in terms of PMS items completed vs. those scheduled, or in terms of actual man-hours utilized vs. man-hours scheduled.

Research and Planning

During the initial stages of my research and planning, I had to account for and schedule every MPC, and add the estimated man-hours for each. It was then that I noticed that for most months, the total estimated man-hours required for all monthly, quarterly, semiannual and annual MPC's rarely exceeded 40 man-hours per month. I realize that the manning levels as well as the PMS man-hour requirements, vary considerably from cutter class to cutter class, as well as from division to division on the same class. However, I had to ask, "Why can't PMS be accomplished at 100 percent if it only requires around 40 man-hours per month?" The answer to that question aboard *Iris* was that the PMS book had been in the engine room in a loose leaf binder and two to three times per week, word would be passed to "Do PMS".

With no planning or guidance, the imaginations and desires of almost all maintenance personnel went into a frenzy. My next question was, "How can anybody possibly report the percentage of PMS completed with this type of organization?"

Resolution to Problem

My resolution to this problem was simple. I made copies of the Main Propulsion MPC's and laminated them. Then, I built a card holder for the laminated cards. The card holder was constructed of angle iron, perforated sheet metal and plexiglass. It had two sections; the left one for pending, and the right one for completed MPC's. Accordingly, the plexiglass in front of each section was stenciled "pending" or "completed". The cards were in the holder behind the plexiglass. According to the MPC's schedule, the laminated cards were placed in the pending side of the card holder. The senior Petty Officer would then give a pending laminated MPC to a maintenance employee. The maintenance employee would then take the laminated card to the job site, and perform the maintenance as directed on the card. Above the pending and completed card holder, I posted a log (see figure 2) for the maintenance employee to record the MPC completion date; how long it took; and any remarks relating to possible future maintenance indicated by the completion of the MPC. The laminated card was then placed in the "completed" section of the card holder. At the end of each month, I simply retrieved the log and cards, keeping the stacks separate, and proceeded to fill in my stats form. Then, I inserted a new set of MPC's along with backlogged MPC's into the "pending" section of the card holder according to the PMS schedule. I kept the laminated MPC's in my file cabinet, and categorized the file as monthly, quarterly, semiannual, etc.

Conclusion

Using this system, kept me in touch with the work being accomplished, and enabled me to become very familiar with scheduling. Don't misunderstand me, there was a backlog, but I knew exactly which MPC's were being deferred, and all I had to do was inform the 1st Class Petty Officer of any critical deferred MPC's, and they were performed as soon as possible. This system also provided me with the specific information I needed to keep key people informed of our maintenance status; to formulate work lists; request CHARLIE periods; initiate CSMP's; and to base my decisions on placing equipment OOC.

I used this system for quite a while. A change in the administration of PMS came with a change in Engineer Officers. My system was temporarily shelved until a CCGD13 (ene) message required specific PMS reporting requirements to be included in the Cutter Engineering Report. The information required was almost exactly the information my report (see figure 1) recorded. The only additional requirements was to provide a list of MPC's which are backlogged, and provide a total number of MPC man-hours scheduled which were not accomplished. All I had to do was refine our old system to match the new reporting procedures and requirements, and use a different form for the report (see figure 3). I continued to complete a monthly report, and simply added the six monthly reports together to form the six-month figures for the Cutter Engineering Report.

Note: When working with man-hours, ensure that the right recommended man-hours match the corresponding scheduled MPC item required. If experience indicates that the estimated man-hour requirement listed in the PMS Manual's index is inaccurate, make a change in your index, and use the more accurate estimate. In addition, for MPC's with multiple equipments, don't forget to multiply the estimated unit man-hours by the number of equipments to arrive at the total man-hour requirement for that MPC.

Maybe somebody out there can work a computer program for this type of shipboard information. Then, we will see how easy it is to gather the information.

I now have 1st and 2nd Class Petty Officers who know the system, and use it properly. The stats are handed to me monthly, and all I have to do is evaluate the month, and take appropriate action as needed. My only task now is to get my percentage levels of performance up to 100 percent!

MPC's Log

_____ FY _____ QUARTER _____ MONTH

	MONTHLY	QUARTERLY	SEMIANNUAL	ANNUAL	HOURLY/ AS REQUIRED	TOTAL
	NUMBER OF MPC'S SCHEDULED					
LINE 1						
	NUMBER OF MPC'S COMPLETED					
LINE 2						
	% MPC's COMPLETED VS. SCHEDULED					%
	MPC MAN-HOURS SCHEDULED					
LINE 3						
	MPC MAN-HOURS UTILIZED					
LINE 4						
	% MPC MAN-HOURS UTILIZED VS. SCHEDULED					%

REMARKS:

Figure 1.

Monthly PMS Log

MPC NO.	DATE	M/H	INIT	RATE	REMARKS

Figure 2.

AUX/DC
Monthly PMS Statistics

QUARTER _____ MONTH _____ YEAR _____

NUMBER OF MPC'S REQUIRED

MONTHLY	QUARTERLY	SEMIANNUAL	ANNUAL	HOURLY	AS REQUIRED	TOTL MPC'S

NUMBER OF MPC'S ACTUALLY COMPLETED

MONTHLY	QUARTERLY	SEMIANNUAL	ANNUAL	HOURLY	AS REQUIRED	TOTAL MPC'S

NUMBER OF MPC MAN-HOURS RECOMMENDED

MONTHLY	QUARTERLY	SEMIANNUAL	ANNUAL	HOURLY	AS REQUIRED	TOTAL M/HR

NUMBER OF ACTUAL MPC MAN-HOURS REQUIRED

MONTHLY	QUARTERLY	SEMIANNUAL	ANNUAL	HOURLY	AS REQUIRED	TOTAL M/HR

PERCENT HOURS SCHEDULED = ACTUAL HOURS REQUIRED/ACTUAL HOURS RECOMMENDED X 100
= _____

PERCENT ITEMS SCHEDULED = MPC'S ACTUALLY COMPLETED/MPC'S REQUIRED X 100
= _____

HOURS BACK LOGGED = TOTAL MPC M/HR RECOMMENDED THAT WERE NOT ACCOMPLISHED AND NOTED BELOW IN THE REMARKS—BACK LOG BLOCK
= _____

REMARKS—BACK LOG

Figure 3.

Chief Engineer's Comments

The author identifies just one of many ways in which to manage the Naval Engineering Cutter Preventive Maintenance System (PMS), and the information available upon completion of cutter PMS items. His article is appropriate in that PMS reporting requirements have been a topic of debate within the Naval Engineering community ever since formal PMS documents were first published. Although district commanders may require some form of completion report for their own management purposes, Commandant currently does not require detailed PMS completion or man-hour utilization feedback reports (see Change 1 to COMDTINST M9000.6, section 090.6.2(1)(f) and (3)(c)(3) along with COMDTINST 4790.1B).

Commandant (G-ENE) plans to publish a standard Coast Guard reporting system for PMS completion as a forthcoming change to the Naval Engineering Manual (COMDTINST M9000.6). The reporting requirements will attempt to balance the true need for PMS completion data with the effort to limit shipboard paperwork and documentation. It must be kept in mind that PMS was not designed as an instrument to place CO's/EO's on report for not completing required maintenance, but to provide cutters and top level management a means to identify a cutter's minimum engineering maintenance requirements in one publication, and to aid cutter engineers in their effort to establish equipment maintenance priorities.

Also, the author identifies the fact that Commandant has not formally established a detailed policy, or provided detailed guidance on how to manage the cutter engineering PMS. The absence of such detail was a conscious decision, primarily to allow each unit as much flexibility as possible in using the cutter PMS as a management tool.

Comments and other recommendations, similar to the author's regarding the management of PMS at the shipboard level are encouraged, and should be addressed to the Headquarters Cutter PMS Manager, COMDT (G-ENE-4F), who is currently studying the issue.

Safe in, Safe out; How the Coast Guard Trains Its Own in Confined Space Entry Safety

LCDR G. R. Colonna
Marine Safety Division
Eighth Coast Guard District
New Orleans, Louisiana

Introduction

The number of hazardous cargoes, approved for transportation in the marine mode, has expanded greatly in the past 20 years. The possibility of Coast Guard Marine Safety personnel, engaged in routine inspection duties, being exposed to such cargoes is significant. In the past, efforts by the Coast Guard have focused upon acute situations, such as flammability and explosion, oxygen deficiency or acute exposure to toxic materials. This is because the hazard assessment process is more readily apparent, and the consequences are more dramatic.

However, as more questions were raised regarding the health impact of chronic, low to moderate level exposures, it became evident that the existing approach was not adequate to address issues pertaining to long-term health. Properties of products shipped in bulk, range from essentially harmless, to water reactive, corrosive, toxic, or unusually flammable. Of those which are toxic, the characteristics may range from moderate to severe. The products may go by names like dripolene, casinghead gasoline, BTX mixtures and pyrolysis gasoline. it is not apparent by their names that each product contains a significant amount of benzene. Sour crude may contain benzene and hydrogen sulfide as well. Potential exposure to these chemicals occurs daily.

Federal law as well as Commandant policy have required that a comprehensive occupational health and safety program be developed to safeguard our employees (reference Executive order 11807, 28 September 1974). A total program would include industrial hygiene exposure monitoring; medical monitoring; and training programs for personnel on workplace hazards, and methods for minimizing health risk.

In 1982, the Eighth District's management expressed serious concern over the potential health risk associated with exposures to Marine Safety personnel during their normal work activities. A working group recommended that an industrial hygiene billet be established in the District to develop and implement an occupational health program for Marine Safety personnel. The Eighth District, with its concentration of petrochemical industries and commercial waterborne transportation, provided the ideal environment to test this fledgling program.

The program was initiated in October 1983. The working group defined a series of performance objectives to guide the development of the program. These objectives were:

- To develop a District-wide program built around a foundation of medical monitoring, industrial hygiene and training.
- To advise personnel of the potential health and safety hazards which exist in the marine environment.
- To assist in the development of safe work practices, and in the education of personnel in the practices, precautions and established procedures to control occupational exposures.
- To upgrade occupational health training.
- To collect exposure and monitoring data for inclusion in the Coast Guard data base to aid in the evaluation of long-term health risk.

As you can see, there is considerable emphasis on hazard awareness, training and education. One aspect of the routine Marine Safety duties has received particular attention, and that is *confined space entry safety*.

Confined space entry occurs reguarly in the marine industry during inspection of barges, ships, MODU's and offshore support vessels. It also occurs on Coast Guard vessels during periodic inspection of fuel and water tanks. The hazards are the same and the proper entry procedures are the same. To ensure these procedures are followed during every entry, the Eighth District initiated a two-step program to combat confined space entry hazards. First, a training course was developed. Second, a policy was established. The industry has become acutely aware of these efforts. The importance is brought more clearly into focus when one considers the recent deaths which have occurred in the marine industry in the Eighth District.

The doctrine which has been adopted in the Eighth District is applicable wherever confined space entry occurs. The essential elements include:

- Testing and inspection by qualified professionals.

- Documentation of testing and inspections.
- Periodic retesting, appropriately documented.
- Ventilation—continuous, mechanical.
- If in doubt, *do not enter* until retested and further ventilated.

The policy and training course provide the management and the workers with the information necessary to implement a uniformly safe program throughout the Coast Guard. Overall coordination of the Marine Safety occupational health program is the responsibility of Coast Guard Headquarters (G-MTH).

The Course

In the Fall of 1983, MIO New Orleans and a group of marine chemists from the local area collaborated on the first "Shipyard Competent Person Seminar" which was offered to the entire MIO. Less than two years later, that same course has been attended by over 500 Eighth District Marine Safety personnel (including all CO's and XO's) and some 60 Second District Marine Safety personnel, as well. Coast Guard Headquarters is presently reviewing the course, and evaluating how to integrate the elements of the course Coast Guard-wide.

With the assistance of Delta Laboratory, this course has become one of the most essential one-day training sessions of every marine inspector.

The course covers confined space entry hazards; the marine chemist program and NFPA 306; and the OSHA shipyard competent person program and 29 CFR 1915.

The training has been extremely well received. Feedback from attendees prompted the development of a policy guidance statement. In October 1984, an Eighth District Instruction on confined space entry safety procedures was issued.

The Instruction

The instruction represents a safe work practice. It collected into one place the appropriate guidelines for entry into confined spaces, and interpreted the requirements for action.

Policy guidance, established with the instruction, covers both routine and nonroutine applications. Effective implementation of the work practice requires that training and education on the confined space entry fundamentals be linked with revision and discussion of the specifically developed policy. This approach represents the basic methodology for application of all safe work practices. The fundamentals of the confined space entry program have been incorporated into a forthcoming change to Volume 1 of the Marine Safety Manual.

As coordinator for the program in the Eighth District, the Marine Safety Special Project Officer provides an audit capability for all safe work practices. The audit involves workplace documentation, and industrial hygiene monitoring and sampling. The results identify where the work practices are successful, and also point out any circumstances which may not be covered by the work practice.

In the case of confined space entry, the audits focus upon proper testing and certification of tank conditions prior to entry. Audits also involve sampling of conditions in spaces during entry to determine if the conditions remain the same as assumed by acceptance of the marine chemist's certificates. Of particular concern is the possibility that liquid residues in the scale of tank walls will regenerate vapors as temperature in tanks elevate with Summer heating of the tanks. Besides the potential vapor exposure, there is the persistent problem associated with heat stress. Researchers recognize that a qualitative relationship exists between fatigue caused by working in heat stressful environments and an exposure to an atmospheric contaminant. Inspectors who exercise all the elements of the safe work practice will hopefully be minimizing the consequences of the various workplace hazards.

Conclusion

The Coast Guard, through its long range planning for Commercial Vessel Safety, has established a program goal to reduce adverse occupational health exposures of its Marine Safety personnel by 50 percent by 1991. The Eighth District's prototype program is the foundation for achieving that goal. Besides confined space entry, Marine Safety personnel, in the Eighth District, receive training in basic industrial hygiene, heat stress, personal protective equipment, and respiratory protection.

The program completes its experimental phase in late FY 86. Once the program has been completely evaluated, it may be expanded to other Districts within the Coast Guard. The Eighth District will meet the target of 50 percent exposure reduction through use of the prototype program.

For confined space entry, successful application of the program will ensure that all confined space entries are followed by safe exits.

It is really very simple: *safe in* means *safe out*!

Chief Engineer's Comments

This excellent article points out confined space entry in an integral part of marine inspection duties and has one of the highest potentials for chemical exposures. There is a need for enhanced training in this area. Additionally, because of the inherent dangers associated with field marine safety duties, there is a need for an expansion of the prototype health and safety program throughout the Coast Guard. Uniformity of safe work practices and confined space entry procedures are essential to protect our personnel.

Letter to the Editor

All of the engineers in the office look forward to the arrival of The Coast Guard **Engineer's Digest.** This journal is always both enjoyable and informative. It is a premier engineering publication, and reflects Coast Guard thinking on many engineering and related subjects. I have followed the **Digest** my entire career.

The Summer 1985 issue highlighted the Coast Guard Engineer of the Year, LCDR D. M. Egan. His achievements are remarkable for their innovation, thoroughness of concept and continuity. It is clear that he is deserving of the award.

His remarks concerning repairs on board the CGC *Polar Star* cause me some concern: "... crawling through the bowels of the *Polar Star*'s heeling tanks, bathed in JP5, ... we can save the mission! ..." The can-do spirit should be highly commended. 'Bathing' in JP5 is another matter. JP5 is a combustible liquid that may contain significant quantities of benzene, toluene and other aeromatic hydrocarbons known or suspected to be carcinogins. An enclosed space containing JP5 should only be entered with extreme caution under controlled conditions.

The remarks do not state that anything was done improperly. The enclosed space(s) may have had forced ventilation to remove accumulated vapors. He may have been encased in an impervious suit, and may have donned a SCBA or air line mask, and even been carrying an EEBA. However, that is not the impression given to the reader. By printing that portion of LCDR Egan's remarks, the **Digest** is endorsing the position presented, albeit passively. Since the remarks have obviously been edited, why not remove the offensive material? The implication is clear: Disregard for personal safety of individuals is endorsed by the Coast Guard if it is mission related.

It is time that *all* Coast Guard members become aware of the proper methods of eliminating and mitigating these exposures through the development and implementation of realistic, practical doctrine to limit possible exposure. This can best be accomplished through a broad ranging program of education involving individual members, supervisors and managers alike.

A journal as prestigious as The Coast Guard **Engineer's Digest** should support the goals of the personal protection program through editorial policy and article content.

CHAS. R. HAVNEN, CDR
CCG D8 (mep)

Editor's Comments

Your point is well taken, CDR Havnen. We certainly agree that LCDR D. M. Egan's remarks do not state that enclosed space entry was done improperly. However, since you state in your letter that is not the impression given to the reader, we contacted LCDR Egan. He assured us all necessary safety precautions were taken in accordance with established directives. LCDR Egan regrets leaving the impression he took little or no precautions for his or his people's safety/health. He further stated that his primary concern is always for his people's well-being.

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Engineer's Digest Questionnaire. Cut out or make copy, fill in blanks, and return to: Editor, **Engineer's Digest,** G-Eg, USCG HDQTRS, Wash., D.C. 20593. *To save time, fold and insert in window envelope with address at bottom.*

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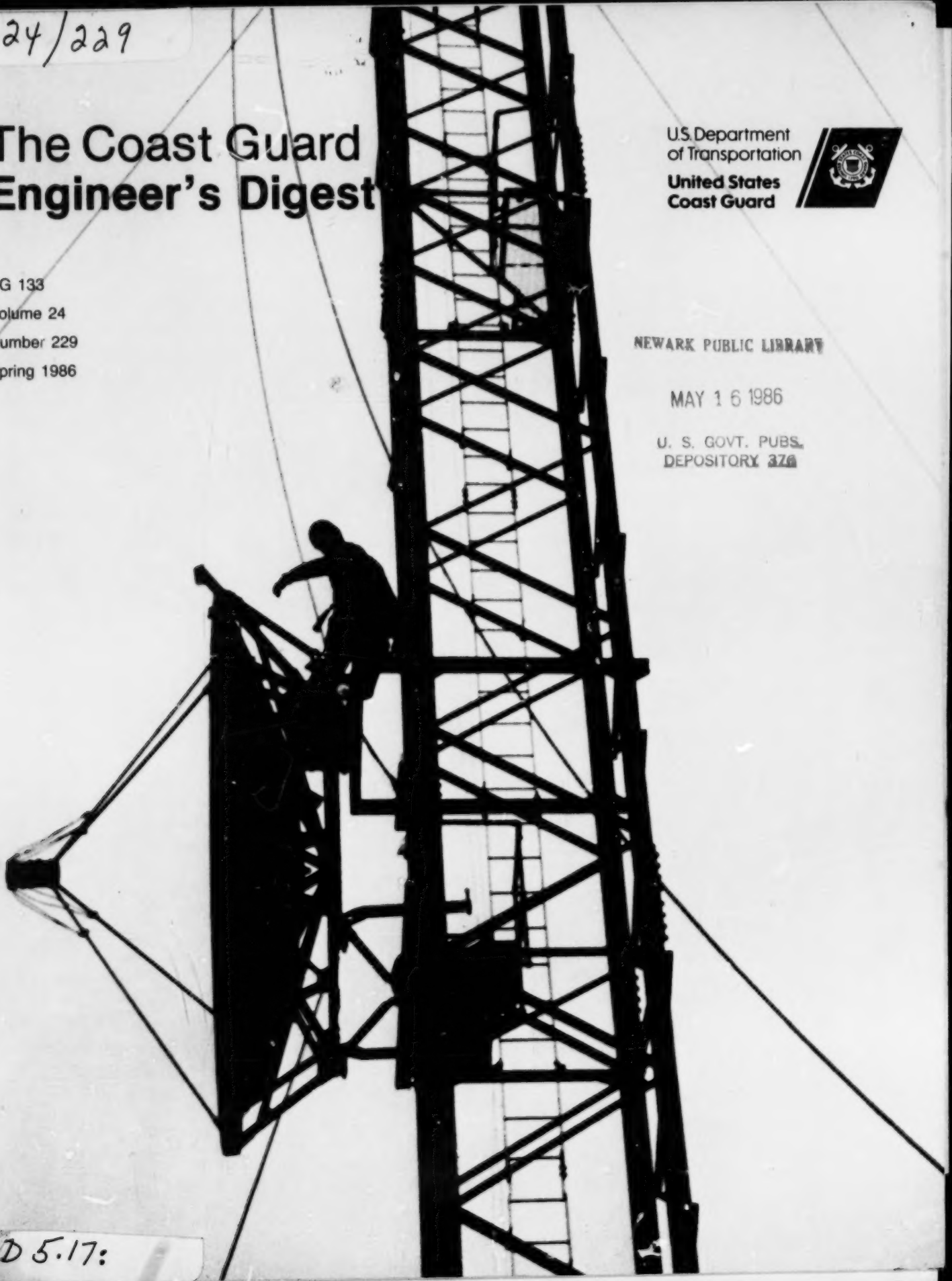

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The Coast Guard **Engineer's Digest**

United States
Department of Transportation
CG-133

Chief, Office of Engineering
RADM K. G. Wiman
Deputy Chief, Office of Engineering
CAPT D. L. Hoffer
Editor
Annette M. Nieves

The Coast Guard **Engineer's Digest** is an official publication of the Office of Engineering, U.S. Coast Guard Headquarters, Washington, D.C. Now published quarterly, the **Digest** has been a medium for communicating new ideas and technology of interest to Coast Guard engineers since April 1933.

The **Digest** is a professional journal for the publication of research papers, special studies, and general interest articles aimed at advancing engineering in the Coast Guard.

While some material for the **Digest** is reprinted from other technical publications, most papers are submitted from the field by Coast Guard engineers and engineering managers, both military and civilian.

The Office of Engineering encourages all Coast Guard personnel in engineering-related fields to share their ideas, experiences, successes, and failures with the Coast Guard engineering community by submitting articles and papers for publication in the **Digest**.

Observe the following guidelines when submitting material for publication:

- Manuscripts should be typed double spaced on one side of 8½ x 11-inch white paper, leaving at least a 1-inch margin on all sides.
- Original articles by Coast Guard personnel (civilian and military) should have a byline, giving name, title, and unit, and a short biography of the author.
- Illustrations—glossy black and white photographs or line drawings—should be approximately 8 x 10 inches in size. In cases where the author does not have adequate facilities for producing finished art, the **Digest** can have artwork made up from the sketches.
- Complete figure captions and figure numbers should be listed on a separate sheet of paper or taped to the back of each illustration. Do not use staples or paper clips on photographs. Protect illustrations for mailing by placing them between pieces of stiff cardboard.

Send articles (original and one copy), letters, photographs, suggestions, etc., to:

Editor, **Engineer's Digest** (G-Eg/62)
U.S. Coast Guard Headquarters
2100 Second Street, S.W.
Washington, D.C. 20593

Unless otherwise stated, all manuscripts are received under the assumption that they are original, have not been previously published, and are not being considered for publication elsewhere. All material accepted for publication becomes the property of the **Digest** and will be returned only by special arrangement.

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The contents of the **Engineer's Digest** are for information only and should not be construed as altering or superseding official regulations, orders, or directives. The ideas and opinions expressed are those of the individual authors and should not be considered to be the official views of the Commandant.

This publication is intended for all hands. Commanding Officers should take the necessary steps to make it available to all military and civilian personnel within their commands.

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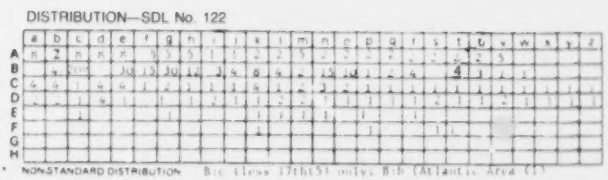

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Front Cover: LCDR Rick Sasse, Assistant Chief Engineer, ACTEUR, removes the hoisting mechanism from the microwave-dish antenna. (See news item on page 9.)

From the Editor

Dear Readers:

- Spring is a time or season of growth or development. The **Digest** is not immune to growth or development, as you may have noticed from recent issues, and will continue to undergo even more changes this year. This spring, I would like to ask you to respond to the questionnaire of last issue. I really need it to determine the future direction of the **Digest.** In addition, your responses will prompt material to be used. There is no time limit on your responses; anytime that it is convenient to do so, pick up a pen or pencil, fill out the form, and mail it to me. Another copy of the form is included below for your convenience.

- Of the few responses to the questionnaire that I did receive, there was one request for more information on what happens to manuscripts that are submitted for publication in the **Digest.** I hope the following will explain the procedures:

  When I receive a manuscript—which should be typed *double spaced* on one side of 8½ × 11-inch white paper, leaving at least a 1-inch margin on all sides—I log it in and review it to determine which Headquarters division has purview over the subject matter. Once I make this decision, I send it to the appropriate division allowing 4 weeks for its return with technical review and Chief Engineer s Comments, if appropriate. Once the manuscript is returned, which often takes more than 4 weeks because of the extensive research sometimes required, I decide whether or not to publish the article—based upon its audience in the general readership, the Headquarters division's recommendation, the timeliness, and the quantity and types of articles available.

  After the cutoff date for each issue, I make the final selection of articles to appear in that issue, edit them (checking for conformance to standard english and agency requirements), and spec the manuscripts using GPO guidelines. (See illustration on next page.) Then, I submit the manuscript, original photographs, print order, and instructions to the printer (yearly contractor selected by GPO). Over a 2-month period, the printer sends me galleys, page proofs, and bluelines for my review and preparation of the dummy (guideline for placement of text and photographs). When everything has been reviewed and re-reviewed, I "okay" for print the final bluelines (also called book blues and repro proofs) and color keys. This is a sketchy account of what is involved in getting a manuscript from initial submission to final printing. Although I have left out the most important step, the author's efforts in getting a new concept or solution to an old problem from mind to paper, I hope the above answers any questions on our printing process.

- Finally, thank you for the many compliments on the last issue of the **Digest.** I received a great deal of positive feedback on LCDR G.R. Colonna's article, "Safe In, Safe Out. How the Coast Guard Trains Its Own in Confined Space Entry Safety". (See Fall 1985/Winter 1986 issue, page 23.) Special thanks to all the respondents to date to the questionnaire. Some of your comments are under consideration; all are appreciated. For those of you who made recommendations on articles to improve the **Digest**, sit down at the word processor or typewriter, put your thoughts on paper, and mail them to me. I might consider them for publication.

Engineer's Digest Questionnaire. Cut out or make copy, fill in blanks, and return to: Editor, **Engineer's Digest**, G-Eg/Rm. 6200, U.S. Coast Guard Headquarters, 2100 2nd St., S.W., Washington, D.C. 20593.

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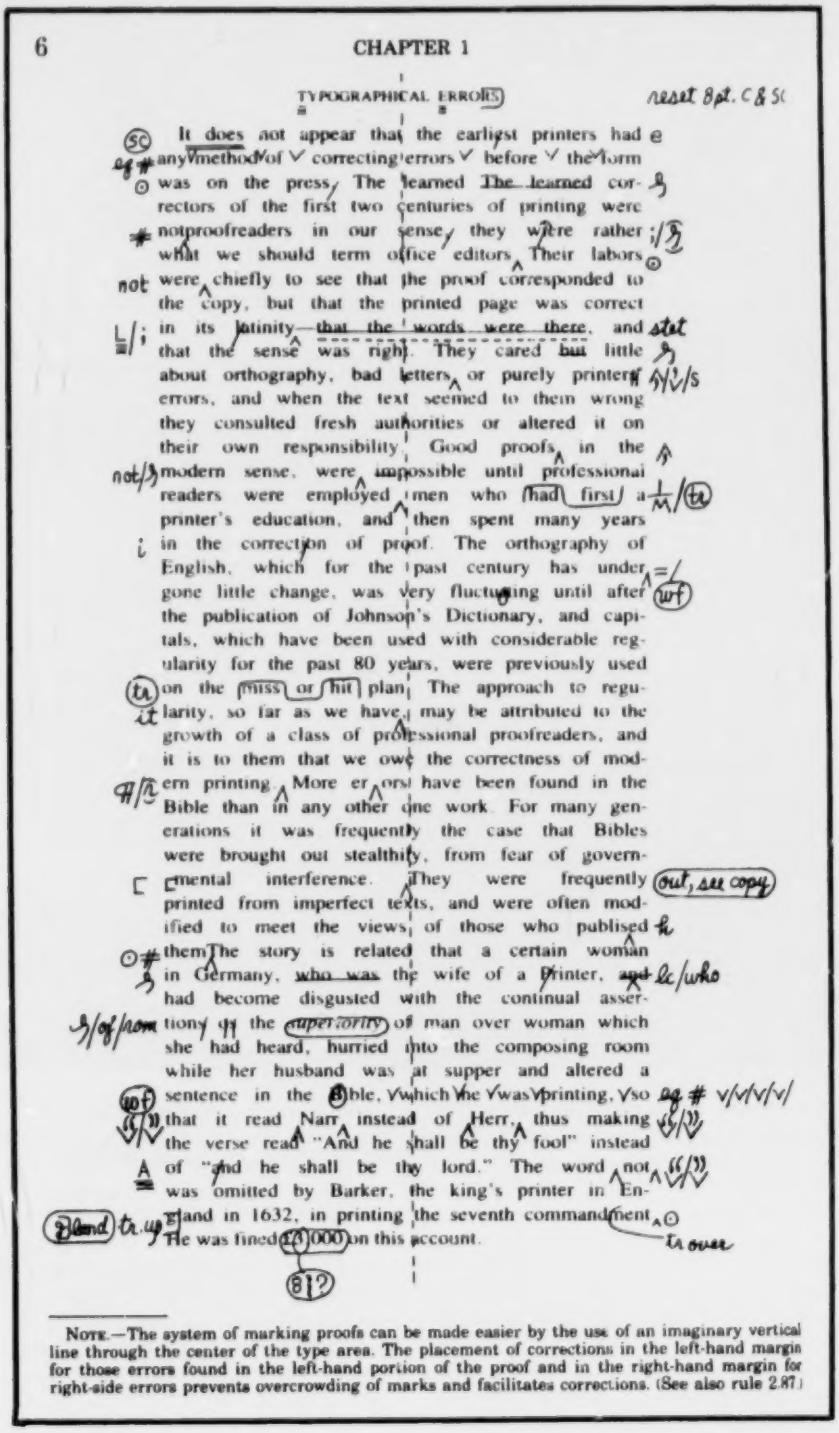
- A special note to those of you who have asked to be put on the **Digest**'s mailing list: I usually honor these requests as long as our supply lasts. But this year, with budget reductions, we are all being forced to do more with less; the **Digest** is no exception. So please bear with me, and try to keep those requests to a minimum. Readers are reminded that the **Digest** can be photocopied without permission.



6 CHAPTER 1

TYPOGRAPHICAL ERRORS

It does not appear that the earliest printers had any method of correcting errors before the form was on the press. The learned The learned correctors of the first two centuries of printing were notproofreaders in our sense; they were rather what we should term office editors. Their labors were chiefly to see that the proof corresponded to the copy, but that the printed page was correct in its latinity—that the words were there, and that the sense was right. They cared but little about orthography, bad letters, or purely printers' errors, and when the text seemed to them wrong they consulted fresh authorities or altered it on their own responsibility. Good proofs, in the modern sense, were impossible until professional readers were employed men who had first a printer's education, and then spent many years in the correction of proof. The orthography of English, which for the past century has undergone little change, was very fluctuating until after the publication of Johnson's Dictionary, and capitals, which have been used with considerable regularity for the past 80 years, were previously used on the miss or hit plan. The approach to regularity, so far as we have, may be attributed to the growth of a class of professional proofreaders, and it is to them that we owe the correctness of modern printing. More errors have been found in the Bible than in any other one work. For many generations it was frequently the case that Bibles were brought out stealthily, from fear of governmental interference. They were frequently printed from imperfect texts, and were often modified to meet the views of those who published them. The story is related that a certain woman in Germany, who was the wife of a printer, and had become disgusted with the continual assertions of the superiority of man over woman which she had heard, hurried into the composing room while her husband was at supper and altered a sentence in the Bible, which she was printing, so that it read Narr instead of Herr, thus making the verse read "And he shall be thy fool" instead of "and he shall be thy lord." The word not was omitted by Barker, the king's printer in England in 1632, in printing the seventh commandment. He was fined £3,000 on this account.

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NOTE.—The system of marking proofs can be made easier by the use of an imaginary vertical line through the center of the type area. The placement of corrections in the left-hand margin for those errors found in the left-hand portion of the proof and in the right-hand margin for right-side errors prevents overcrowding of marks and facilitates corrections. (See also rule 2.87.)

Annette

Message from the Engineer of the Year

"Keeping the Coast Guard Strong"

Being honored as the Coast Guard's Engineer of the Year gives me great pleasure. I am glad to see such recognition given to marine safety. I believe that this award is more a statement of what we, in the Marine Safety Program, have achieved than what one individual has accomplished. Let me add that the Marine Safety Program is not the only program that has achieved excellence. The Coast Guard could not enjoy its fine reputation, nationally and internationally, if it was not for the good work performed by all the people in the Coast Guard.

If we are to survive and maintain our excellent reputation, we need to maintain our strong leadership and a continued dedication to duty.

Needless to say, the Coast Guard is faced with many challenges today—budget cuts, A-76, and anti-regulatory issues. If we are to survive and maintain our excellent reputation, we need to maintain our strong leadership and a continued dedication to duty. As in the past, we engineers have a major role to play in keeping the Coast Guard strong.

Howard L Hime

Howard L. Hime receives his plaque from Joseph H. Kuranz, President of NSPE, as RADM John W. Kime looks on.

Howard Hime Chosen as Coast Guard Engineer of the Year

Mr. Howard Hime, Mechanical Engineer, Office of Merchant Marine Safety, was recently chosen as the Coast Guard's Engineer of the Year. He received his award on 19 February 1986 in Washington, D.C., as part of a program sponsored by the National Society of Professional Engineers (NSPE) in conjunction with National Engineer's Week. Mr. Hime has been employed in the Engineering Branch, Marine Technical and Hazardous Materials Division, since 1977. His areas of expertise in the marine engineering field include boilers, pressure vessels, piping systems, materials, and welding. Mr. Hime represents the Coast Guard on the prestigious American Society of Mechanical Engineer's (ASME) Board on Pressure Technology Codes and Standards, the ASME Boiler and Pressure Vessel Main Committee, and the International Maritime Organization's Working Group on Diving. He has applied his knowledge of industry codes and standards to reduce both Coast Guard and industry costs while maintaining a high level of safety for commercial vessels. Mr. Hime's accomplishments include publishing Coast Guard regulations that adopt ASME certification and third party inspection for marine boilers and pressure vessels. These rules have saved the industry and the Coast Guard an estimated $1 million annually. His other achievements include negotiating an international standard for diving systems, developing a long needed standard for hydraulic hose fittings, and managing several extensive studies of materials and hydraulic components. Mr. Hime has employed his expertise to the benefit of a full range of Coast Guard programs at Headquarters, in the field, and for other Government agencies and the marine industry.

Fiscal Year 1986–87 Major OE Shore Projects Selected

Recognizing that a single high-cost, shore rehabilitation project may be disruptive to an allotment unit's normal level of funds available for maintenance and repair, Commandant (G-ECV) provides separate funding for specific projects that exceed 15 percent of the unit's annual OG43 allotment. To be considered for this alternative funding source, projects must be submitted by letter annually prior to 1 June and have a completed STRUCTALT available for the selection committee to review.

For the fiscal year 1986–87 program, the following projects were selected:

Allotment Units	*Project Description*	*Estimated Cost*
7	Sta St. Petersburg Moorings Bulkhead	1500K
8	Base Galveston Bulkhead Repair	301
9	Two Rivers Sta Bldg Renovation	433
12	SUPRTCEN Alameda Bldg 15 Rehab	610
13	SUPRTCEN Seattle Piers 36, 37	1957
14	Omsta Hawaii Valley Span	1200
PETA	Sewer Collection System Rehab	430
ACTE	Lorsta Sylt Tower Maint	315

SWATH Update

The Small Waterplane Area Twin Hull (SWATH) design has been completed. The salient features describe a SWATH ship that is 138 feet long, has a beam of 60 feet, has a draft of 14.5 feet, and displaces 600 long tons. It is designed to carry and support an HH-65A helicopter, has 10+ days endurance, has a range of 3,600 nautical miles, and has a top speed of 20 knots. The SWATH is designed to meet a mid-level, multimission capability, with an emphasis on ELT and SAR. It has accommodations for 37, with a crew of 35 planned. The propulsion plant consists of two high-speed, 4,000-horsepower diesels connected to controllable pitch propellers via vertical reduction gears. Totally movable canards forward and stabilizers with movable flaps aft, further improve its seakeeping characteristics. The SWATH is capable of unrestricted operations in sea state 5 and survival (restricted capability) in sea state 7.

Specifications have been prepared and contract drawings completed.

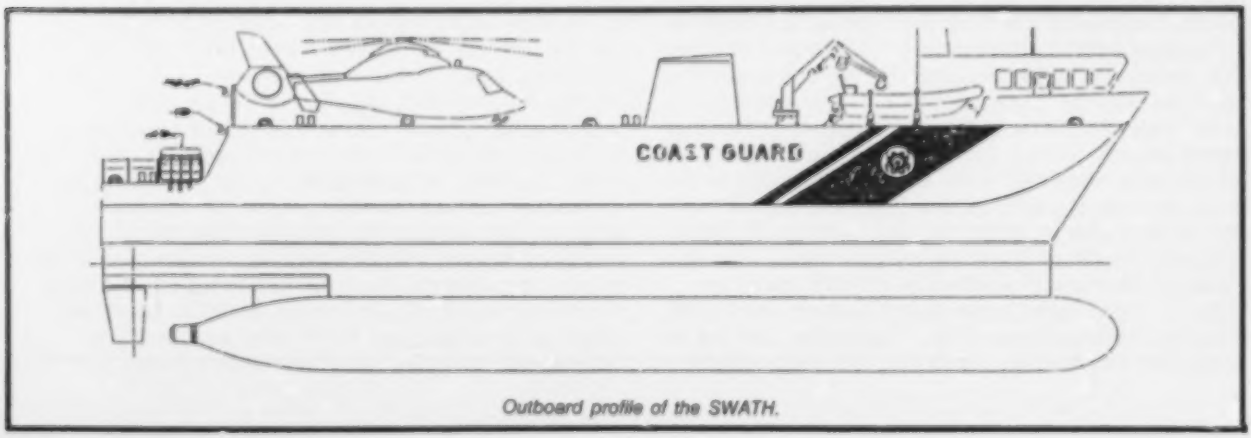
Due to budget constraints and other factors, contract award for detail design and construction of the SWATH will not be pursued at this time. A joint venture with the U.S. Navy for SWATH construction and technology is being pursued. The results so far are mixed, with the Navy expressing an interest in our program but with an overriding concern for their SWATH T-AGOS program.

We Ain't Goin' Away; We're Just Reorganizin'

The Headquarters Ocean Engineering Division (G-EOE) was created in the late 1960s to enhance engineering support of the oceanography and AtoN programs and then to develop pollution programs. A lot of things have changed since then, including termination of the servicewide oceanographic mission, a reduction in the scope of major pollution response equipment acquisitions, and a recent steady reduction in billets and positions.

As part of an overall Headquarters staffing reduction last summer, we had to eliminate a further significant portion of the billets in the Ocean Engineering Division. We chose to eliminate the senior staffing and division management billets rather than any more of the project engineer positions. This decision was based on the conviction that we could not afford to significantly reduce the critical engineering support being provided to the Aids to Navigation, Marine Environmental Response, and diving programs. We are now reorganizing the remaining core of the division as part of the Headquarters Civil Engineering Division (G-ECV).

We hope to have this new structure in place by June 1986 and publish its details, such as new phone numbers, names, and duties, soon thereafter. We intend to leave both the ocean engineering and engineering physics specialties essentially unchanged. Again, we are undergoing this change because of a billet reduction and not necessarily as an efficiency move. By the same token, we are trying to do it as efficiently as possible while also minimizing the impact on other programs, districts, and Headquarters units to which we provide direct engineering support. Any questions? Call someone else. My billet was eliminated. Not really! Call FTS 426-1286.



Outboard profile of the SWATH.

BUSINESS AND PROFESSIONAL
WOMEN'S FOUNDATION

2012 MASSACHUSETTS AVE. NW
WASHINGTON DC 20036
202 · 293 · 1200

BPW Engineering Loan Fund Assists Women to Qualify for Outstanding Career Opportunities

Women accounted for 13 percent of the science and engineering workforce in 1982, double their representation 10 years before. These women are blazing new frontiers and are visible proof of women's ability to succeed in a technical, highly specialized work sphere.

Careers in engineering challenge women to make varied and significant contributions to improving or solving numerous technological, environmental, and social problems in the world of the present and the future. No other profession offers career potential with as many diverse specialties, applications, and work environments.

Women are applying to engineering programs in greater numbers each year. The key factor in reaching the decision to enter and complete these studies is most often the availability of financial assistance.

The Business and Professional Women's (BPW) Foundation Loan Fund for Women in engineering increases the pool of qualified women for professional engineering positions by providing financial assistance to encourage women to enter and complete engineering studies. Since 1976, over $330,000 has been awarded to women in the final 2 years of undergraduate, refresher and conversion, and graduate engineering studies.

The Fund provides for tuition, fees, and related expenses such as child care and transportation. The amount to be loaned to any individual may not exceed $10,000; recipients may re-apply if the maximum amount is not granted on a 1-year basis.

Eligibility requirements include written acceptance for study in a program accredited by the Accreditation Board for Engineering and Technology, U.S. citizenship, and financial need. Women students must also be within the final 2 years of their programs. Study may be full or part-time, but at least six semester hours or the equivalent must be carried for each semester a loan is requested. Both work experience and academic achievement will be considered.

Special encouragement is offered to women with work experience in engineering or related technical fields and to those who have not recently worked in engineering but are qualified through past study, for training in engineering or engineering technology.

Applications for the fall 1986 semester are available *after* February 1, 1986. Completed applications are due by May 1, 1986. For applications and/or further information, write to Loan Fund for Women in Engineering Studies, BPW Foundation, 2012 Massachusetts Avenue, NW, Washington, D.C. 20036.

First Programmed Depot Maintenance for Falcon

On 10 December 1985, HU-25A 2106 completed the first Programmed Depot Maintenance (PDM) at the Coast Guard Aircraft Repair and Supply Center (ARSC) in Elizabeth City, NC, and was returned to operational service at Coast Guard Air Station San Diego. The HU-25A has joined the family of 16 aircraft types to be overhauled at ARSC since 1948. Since completion of the last HH-52A in June 1985, the current production line consists of the HU-25A, HH-3F, and C-130 modification program.

The first HU-25As were delivered to the Coast Guard in February 1982 and will be returning to ARSC every 3 to 4 years for PDM. While PDM is not technically a complete overhaul, the aircraft is extensively disassembled, inspected, repaired as necessary, reassembled, and painted. The evolution takes 4 months and requires approximately 5,000 man-hours.

Preliminary planning is already underway for the first overhaul of the new HH-65A helicopter which joined the fleet in 1985.

Aircraft Repair and Supply Center (ARSC) personnel and the 2106.

USCGC Thunder Bay on sea trials.

140-Foot WTGB Update

Thunder Bay, the newest 140-foot tug icebreaker, has successfully completed preliminary acceptance trials. Following delivery in Seattle, WA, the precommissioning crew will sail the vessel to its home port in Portland, ME.

Anticipated port calls include San Diego, Manzanillo-Canal Zone, Key West, and Charleston.

The ninth 140-foot WTGB will be constructed by Bay City Marine, Inc., in San Diego, CA.

Reporting Quality Deficiencies in Primary Batteries and Other Products from GSA Contracts

The General Services Administration (GSA) requires the use of the Quality Deficiency Report (SF-368) for reporting quality deficiencies in primary batteries obtained through GSA. This does not include shipping-related discrepancies. Those are reported by using the Report of Discrepancy (SF-364).

The GSA regional office will not accept a verbal or written complaint concerning quality deficiencies in primary batteries unless it is accompanied by a Quality Deficiency Report. This is GSA's way of saying "put up or shut up" when complaining about quality deficiencies on primary batteries obtained through GSA. So, if you choose to formerly report deficiencies in primary batteries obtained through GSA, the SF-368 may be ordered using NSN 7540-00-133-5541. For detailed instructions on filing the report, read Encl. (V-4) to COMDTINST M4400.13, CH-8, Comptroller's Manual, Vol. III.

This is good information as the SF-368 applies to all products obtained through GSA and DOD except motor vehicles and their components.

The Quality Deficiency Report for primary batteries should be sent to he GSA regional office in Atlanta, GA. Courtesy copies should be sent to Commandant (G-EOE), Commandant (G-FQA), and the National Aids to Navigation School.

AtoN Primary Battery Warranties

Warranties for primary batteries obtained through the General Services Administration (GSA) have the same warranties that apply to commercial industry. The U.S. Coast Guard is required to obtain primary batteries through GSA, so the warranties applied to them need to be understood.

SAFT America, Inc. and McGraw-Edison Co. have both indicated that, if their battery fails before its rated battery discharge time (RBDT), they will compensate the remaining RBDT with a discount toward the next purchase or with another battery equivalent to the remaining time. However, this does not cover personnel errors, buoy pockets full of water, overtorqued lifting eyes, etc. For detailed information on primary battery warranties with these two manufacturers, write or call the salesman or the national office. We are their customer.

SAFT America, Inc.
711 Industrial Blvd.
P.O. Box 1886
Valdosta, GA 31603-1886
(912) 247-2331

McGraw-Edison Co.
Power Systems Division
75 Belmont Ave.
P.O. Box 28
Bloomfield, NJ 07003
(201) 761-3700

BOSS New York

As part of the required OMB Circular A-76, productivity reviews of commercial activities in the Coast Guard, Commandant (G-A76) is conducting a special study at Support Center New York unlike any the Coast Guard has previously undertaken. This study combines many of the commercial activities on Governors Island into one review package, known as Base Operating Support Services (BOSS). The BOSS will cover about 250 positions and billets for services covering everything from library services to grounds maintenance.

The method being considered to evaluate the successful contractor is a negotiated procurement process. Through this process, the Government will obtain and critically review potential contractors' technical, management, and cost proposals. On the basis of their proposals and a pre-established scoring system, the potential contractors compete among themseives to be selected as the "offerer most advantageous to the Government." The lowest bidder is not necessarily the one selected. In this way, it is not just costs that determine the successful contract bidder but rather a combination of costs, management, and technical approach. The cost proposal of the selected offerer is then compared with the Government bid, including A-76 cost adjustments such as taxes and contract administration costs to determine the lowest bidder. The offerer's bid must be lower than the Government's price by at least 10 percent of the Government's personnel costs before the services will be contracted out.

ACTEUR Tower Engineers Receive Training in Safety and Construction

In November 1984, Coast Guard Activities Europe (ACTEUR) contracted British Telecom to institute an 8-day, tower training course for its tower engineers. British Telecom requires all of its engineers who work on antennas to attend a similar course. Such a course enables an engineer to gain a basic knowledge of what is involved in a tower rigging and assembly operation. British Telecom feels that this knowledge is essential because it gives its engineers an appreciation as to what a rigging gang can be expected to accomplish and how long a particular evolution should take.

Until now, ACTEUR has been educating its engineers in antenna inspection and maintenance through a program of on-the-job training. The philosophy of learning tower safety from various contractors may be compared to taking lessons from a fox on how to guard the chicken coop. The purposes for the training sessions in Rugby were:

- To share ideas and techniques with another tower maintenance agency.
- To have the opportunity to learn safety and construction techniques from an organization that is not being squeezed by the profit motive.

The focus of the entire training session was learning and practicing the use of safe construction and rigging techniques. At Activities Europe, we do not design our towers from the ground up. Our tower engineering involves maintenance. From our experiences in Rugby, we had our first formal instruction on the hardware and the safe design practices concerning "gin poles" erection, winch systems design and maintenance, and the other erection equipment involved in tower construction and maintenance.

Also in Rugby, we were given training in the practical "how to" phase of guyed-antenna construction. It is not enough just to see the rigging equipment and to be instructed on how it works. To gain a real feel for antenna construction, you need to rig a "gin pole" and actually build a guyed antenna. Only then can you see how easy it is to injure somebody by making a mistake. You can also see from up above how difficult it is to communicate with the crew down below. As inspectors, we should now know what it takes to make a good tower crew or, more

Left to right: Phil Baker, Engineering Technician, ACTEUR; Ben Herrick, G-ECV-2, ACTEUR; LCDR Rick Sasse, Assistant Chief Engineer, ACTEUR; and three instructors from the British Telecom Antenna Rigging School.

importantly, what to look out for from a poor tower crew.

British Telecom bases its safety standards on its interpretation of the Factories Acts No. 94 of 1966 and No. 1581 of 1961 (the U.K. equivalent of OSHA). The basic philosophy behind this act is "the employer is obligated not to endanger his employees at his place of work." Although working aloft in a guyed antenna several hundred feet above the ground can in no way be considered a safe occupation, the instructors from British Telecom emphasized repeatedly ways to minimize the danger. In contrast to what we have heard from many antenna contractors, we found that safety gear is not so terrible an inconvenience; we also found that it is possible to set a "gin pole," erect tower sections, and still be safely attached to the structure.

Everybody felt that our training in Rugby was a tremendous success. The sessions were more than just training sessions; they were opportunities to exchange ideas and draw upon the experience of another agency that is in the antenna erection and maintenance business. The exchange of information went two ways, and both parties benefitted from the exercise.

PMS Works!

Commandant (G-EOE) recently received letters from Commander, Group Hampton Roads, and Fifth District (ecv) which give a sterling example of why we have a Preventive Maintenance System (PMS) for automated lighthouses, and what it can accomplish if used correctly.

In the spring of 1980, Chesapeake Light, an offshore tower, was automated under the Lighthouse Automation Project (LAMP). After the automation, the site was plagued with electronic and mechanical failures. Group Hampton Roads had the responsibility for maintaining the lighthouse, and for 3½ years, they valiantly chased the "gremlins" but still the time between visits by Group personnel was 30 days or less. Finally, in January 1984, the problems climaxed with an engine generator changeout followed by a number of engine failures over the next couple of weeks.

The Group Engineering Officer, CWO4 Moore, decided it was time to quit chasing "gremlins" and make the system work the way it was designed. CWO4 Moore had served a previous tour at Headquarters where he was involved in the training, maintenance, and procurement requirements for equipment used on unmanned lighthouses. In early 1984, he developed and implemented an extensive training program for all engineering personnel tasked with maintaining the Group's unmanned lighthouses. With the personnel properly trained, the Lighthouse PMS (COMDINST M16500.10) was enforced with a well-thought-out PMS management program.

In May 1985, Commander, Group Hampton Roads, and Fifth District (ecv) were proud to announce that Chesapeake Light had operated successfully for 15 months without a failure. The Group was able to do this with routine, scheduled PMS visits every 90 days. The savings in dollars and resource hours are obvious.

This shows that PMS can reduce a unit's workload while increasing the reliability of a lighthouse. All it takes is knowledgeable, first-level supervisors, trained and experienced technicians, and a well-managed PMS Program such as the one at Group Hampton Roads. It also points out the need for maintenance supervisors to be knowledgeable about the equipment at an automated lighthouse.

In order to meet this need for knowledgeable maintenance supervisors, Fifth District (ecv) has recommended that a course be developed for the supervisory level giving an overview of the total automated system at unmanned lighthouses. Commandant (G-EOE) concurs with the recommendation, and the National Aids to Navigation School intends to take the lead in fostering the development of a suitable course.

Thinking About Writing An Article? Don't Hesitate! Write It NOW

CGC *Blackhaw* Synthetic Riser Project

By LCDR R. W. Brandes
Aids to Navigation Branch
Fourteenth Coast Guard District
Honolulu, Hawaii

Introduction

Reduced freeboards on 8 × 26 and 9 × 38 buoys have long been a problem along the central and northern California coasts. A 1½- and 1¼-inch riser chain is used on these moors to accommodate the prevailing swell and surge conditions in depths of up to 200 feet. Riser weight in these depths reduces buoy freeboards below the minimum specified in the Aids to Navigation (AtoN) Technical Manual and has created serious problems in sound signal operation and maintenance. Low-riding whistle buoys give off a muted and irregular signal, and bell and gong tappers suffer increased wave damage when positioned close to the water. Further, low freeboard buoys experience more sea growth, which adds to vessel servicing time and reduces the quality of the advertised color daymark.

Previous attempts to maintain minimum freeboards have employed either "floaters" or the use of lighter chain risers. Fifth-class nun and can buoys have been attached to the riser on a mid-level loop chain to provide buoyancy. This procedure proved cumbersome but temporarily did provide the desired freeboard. After a year on station, floaters were invariably recovered in a flooded condition caused by abrasion against the mooring chain. Once flooded, a negative buoyancy factor was created, which further decreased buoy freeboard. The use of smaller diameter riser chain was effective in maintaining minimum freeboard but only within strict limitations. Experience proved that riser chain diameters of less than 1¼ inch do not survive the winter swell conditions north of Point Arguello. The combined weight of 1¼-inch riser chain, bridle, swivel, shackles, and 15–30 feet of 1½-inch or greater chafe chain produced a "low rider" in depths over 140 feet.

Use of Nylon Risers

The continuing development of synthetic mooring material appeared to offer a means of achieving minimum freeboard standards on *Blackhaw* coastal buoys. In April 1983, the NOAA National Data Buoy Office (NDBO) and Commandant (G-EOE-4) were contacted to determine the feasibility of utilizing synthetic riser sections on selected coastal moors. The Coast Guard staff at NDBO was supportive and provided preliminary information on synthetic lines on the market and proven splicing techniques. G-EOE-4 advised that synthetic risers were approved in concept, and that a double-braid nylon riser was being fabricated under contract for deployment at Blunt's Reef exposed location buoy (ELB). Discussions with the Eleventh District (oan) staff were useful in gaining an insight into the deep-water nylon moors in use in southern California and Puget Sound. With District (oan) approval, a Twelfth District demonstration project was initiated to select a synthetic mooring material, to develop a method of retrieving 140- to 200-foot riser sections for annual service, and then to prove the concept in the field.

Twelve buoy stations were selected for the initial demonstration in varying geographical/environmental locations. Eight of these stations were in depths of 140–198 feet. Two stations were selected in the 120- to 139-foot range where servicing history indicated low freeboard-related problems of sea growth or excessive tapper maintenance time. Two additional sites were selected in San Francisco Bay where buoy submergence problems had been encountered during periods of heavy spring runoff.

The synthetic material selected was 2¼-inch, 8-strand plaited nylon. The 8-strand line was readily available at Base Yerba Buena Island as excess NDBO mooring line and had a breaking strength roughly equivalent to 1½-inch chain. NDBO's experience with this line upheld the manufacturer's claim that the spliced line would retain 90–95 percent of its strength. This became a major consideration since all splicing would be accomplished by the *Blackhaw* Deck Force. With over 9 years of experience with 8-strand nylon, NDBO has yet to observe a splice failure in the field. Finally, it was noted that 8-strand will not "hockle" or twist following repeated applications of a strain. This would facilitate annual mooring inspections. The strength, cost, and weight advantages of eight-strand line over contract chain are illustrated in table 1.

Developing a method of retrieval was the next challenge. NDBO does not have experience retrieving deep-water synthetic moors and could not be of assistance. The Eleventh and Thirteenth Districts retrieve deep-water moors using the synthetic line handling system (SLIHANDS) described by Steve Roush in the January–March 1981 *Aids to Navigation Bulletin*. This system was not suitable for nylon risers less than 200 feet in length and would not be available to meet

	1¼-In. Chain	1½-In. Chain	1¾-In. Nylon	2¼-In. Nylon
Weight per Ft. (Lbs.)	13.4	19.3	.83	1.3
Breaking Strength (Lbs.)	91,000	131,000	78,000	125,000
Cost per Ft.	$4.73	$6.97	$1.52	$2.70

Table 1.

Synthetic Moor Stations

Station	Buoy Hull	Station Depth (Ft.)	Chain Riser Replaced	Riser Length (Ft.)	Lbs./In. of Immersion	Free-board Gain (In.)
Piedras Blancas LWB	9 × 38	186	1¼	150	300	6.1
Von Helm Rock LGB	8 × 26	140	1¼	100	270	4.5
Point Buchon LWB	9 × 38	147	1½	100	300	6.0
Point Pinos LWB 2	9 × 38	198	1¼	150	300	6.1
SF S Trf Lane LB A	8 × 26	120	1¼	75	270	3.4*
SF Main Trf Lane LGB B	8 × 26	180	1¼	150	270	6.7
Noonday Rock LWB NR	8 × 26	140	1¼	100	250	4.8
Estero Bay LWB	9 × 38	168	1¼	125	300	5.0
Monterey Danger Area LB B	8 × 26	134	1¼	100	270	4.5*
Monterey Danger Area LB A	8 × 26	192	1¼	150	270	6.7
SF Bay North Ch B 18	2N	106	1⅛	60	67	6.5**
Harding Rock LB HR	6 × 20	57	1⅛	40	150	2.5**
Blunt's Reef LHB B ELB	9 × 40	188	1¼	140	300	5.6***

Notes: *History of sound characteristic or sea growth problems.
**Nylon riser installed due to submergence in heavy currents.
***Commandant (G-EOE-4) project for a 12-strand nylon riser.

Table 2.

Blackhaw's annual buoy servicing schedule. The method developed would have to be simple, inexpensive, and fully reliable. After consideration of several alternatives, BMC Telefoni's suggestion was adopted to splice eyelets at 25-foot intervals. This increased moor fabrication time but allowed use of conventional moor retrieval procedures. On 2¼-inch line, the eyelet, spliced into the standing part of the riser, is wide enough to rest in the stopper much like a link of chain. When the professionally spliced 140-foot riser for Blunt's Reef ELB was delivered without lifting points, it became obvious that Telefoni eyelets were an invention whose time had arrived.

Table 2 lists the twelve buoy stations selected for the demonstration project along with the calculated freeboard gains. Though Blunt's Reef ELB was primarily a G-EOE-4 experiment, it is listed at the bottom of the table for comparison. Freeboard gain was calculated as follows:

$$\text{Freeboard Gain} = \frac{(\text{chain weight} - \text{nylon weight})\ (\text{riser length})}{(\text{buoy pounds per inch of immersion})}$$

Figure 1 diagrams the designed nylon riser mooring arrangement. The 15-foot length of chain between the bridle and riser was added as a safety consideration to permit detachment of the buoy while the moor is held by chain in the stopper. Split key shackles are used at the bridle, sinker, and top of the nylon riser. Hot pin shackles are used elsewhere. The length of the nylon riser is designed to be approximately 75 percent of the water depth to ensure the lower splice does not abrade against the sea floor.

Deployment

The 12 demonstration risers were deployed during scheduled aid visits between August 1983 and November 1984. Photographs on pages 13 and 14 illustrate aspects of a typical deployment. A steel thimble was used to attach the end splices tc chain. The conventional thimble was used at 8 of the 12 project stations while 4 stations were selected randomly for use of the shielded Samson nylite connector to compare abrasion. The price of the steel thimble is approximately one-fourth the cost of the Samson product. A lifting eyelet was spliced into the riser. With some experience, the ease of splicing 8-strand, claimed by the manufacturer, was achieved. Nylon eye-splicing became a routine, inport-duty section task during the early stages of the project. Heavy canvas was used to guard the nylon line from the heating torch in the "heat and beat" operation.

Steel thimble attaches end splices to chain.

Results to Date

To date, five of the deployed risers have been retrieved and inspected. The lifting eyelets have performed well through the first annual service, showing no signs of load distortion or abrasion. During the retrieval of Piedras Blancas LWB 4A, two of the eyelets were more than 30 feet apart, which created problems booming over far enough to get the next eyelet in the stopper. This necessitated the use of a wire strap to grab the lower eyelet and pointed out the need for quality control in the eyelet-splicing process. Inspection of end splices have revealed no sign of wear or deterioration. Though the nylon manufacturer warned of possible abrasion against the side of the ship while the nylon was being held in the stopper, this has not yet surfaced as a problem. Good ship control can minimize this concern. Sea growth on the riser has been less than anticipated and has not hampered riser recovery. Should excessive organic growth be encountered, it can be removed with fire main pressure. Finally, a significant cost saving has already been realized as a result of the price differential between nylon line and chain.

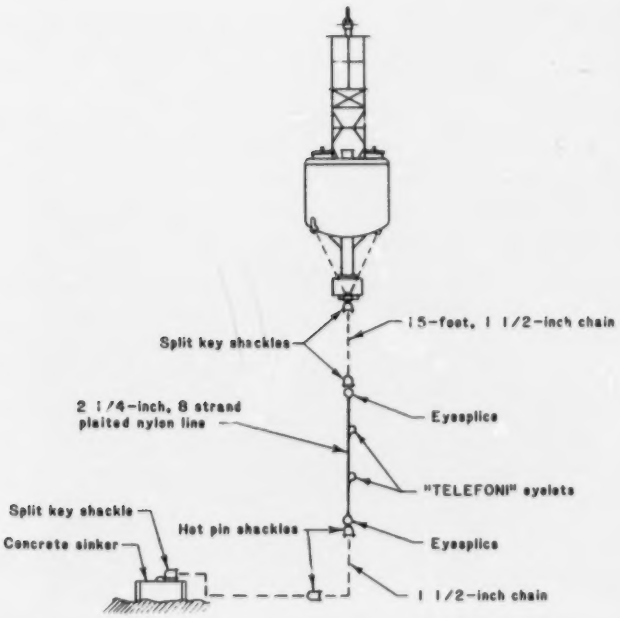
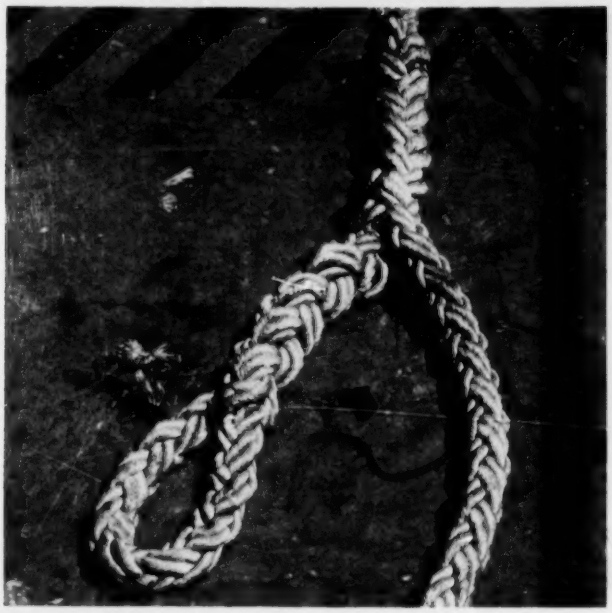


Figure 1.

There has not been a nylon moor failure on any of the buoys in the *Blackhaw* demonstration project. A failure did occur on the G-EOE-4 contractor-fabricated riser on Blunt's Reef ELB. The double-braid nylon parted at the upper thimble splice during an intense southwest storm in December 1983. The ELB was recovered and redeployed using a temporary 1¼-inch chain riser. In October 1984, the ELB was again deployed using a G-EOE-4 procurred 12-strand nylon riser with a protective urethane coating.

In December 1983, the nylon riser on Harding Rock LB HR in San Francisco Bay was subjected to an unusual survival test. The buoy was run over by an outbound towboat and barge. The moor parted, and the buoy was set adrift. When recovered, it was determined that the moor parted in the 1¼-inch chain chafe which had recently been replaced. The nylon riser was intact and none the worse for wear. The riser was later redeployed on the same station with a new buoy.



Lifting eyelet splices into riser.

Future Considerations

The use of nylon risers in the Twelfth District is well justified in terms of both cost savings and improved buoy performance. Eight-strand plaited line has the necessary strength characteristics for the task, is reasonably resistant to abrasion, and is easily spliced. Eight-strand is also less expensive than 12-strand and polyester lines currently on the market. Although polyester has more strength size for size, better dynamic loading qualities, and withstands abrasion better, the need for these attributes is not evident. Further, the reduced stretch of polyester under load is probably undesirable in shallow-water moors.

Only preliminary conclusions are available at this early date. The continued use of 2¼-inch, 8-strand nylon is warranted in the immediate future due to its suitability for the job, local availability, and price. Over the long run, 1¾-inch, 8-strand may prove more effective due to its ability to stretch under heavy loads. This quality might prevent moor failures under conditions of shock loading that would occur when a buoy is struck by a vessel. Conversion to shielded attachment hardware, such as the $385 Samson nylite connector, is probably desirable but not essential. Abrasion has not been observed using the $80 federal stock thimble. There appears to be no reason to incur the increased expense of coating nylon risers with urethane. Water column abrasion and "fish biting" are not problems in the Twelfth District.

The one major question that this demonstration has not yet answered is: "How long will a nylon riser last on station?". The answer seems to lie between 6 and 10 years. For the present, a 6-year replacement cycle is planned.

About the Author

CDR Richard Brandes is presently assigned as Chief of Aids to Navigation Branch, Fourteenth District. He is a 1970 graduate of the Coast Guard Academy and received a M.S. degree in management from Rensselaer Polytechnic Institute in 1974. Previous tours include CGC Storis, *CGC* Spar, *CCGD11 (mepps), LORSTA Marcus Island, LORSTA Iwo Jima, and MSO San Francisco. He served XO and CO tours aboard CGC* Blackhaw *in San Francisco, CA.*

Chief Engineer's Comments

We concur with the Twelfth District's approach in using synthetic line in the riser portion of the mooring. Their specially designed synthetic risers with retrieval pendants are considered to be the prototype mooring for future Coast Guard-wide application in deep water. Experience has shown that synthetic lines are suitable for mooring buoys in deep water. (Deep water is considered to be water in excess of 100 feet in depth.) We discourage the use of synthetic lines on lighted buoys in less than 100 feet of water. R&D studies indicate that, in shallow water, the buoy may be too active for proper identification of the light.

Testing of totally synthetic, moored, unlighted buoys in water depths less than 50 feet is being conducted in the Fifth and Thirteenth Districts. Later on this fiscal year, we intend to test synthetic moorings for unlighted buoys in water depths ranging from 50 to 100 feet. We have also scheduled to further demonstrate the use of deep-water synthetic risers in both the First and Fourteenth Districts. This demonstration will utilize polyester line in various environmental conditions to extend our knowledge. If you have an application for synthetic line moorings, a freeboard problem with a buoy station, or a question on synthetics, contact Mr. Dean Smith (G-EOE-4), FTS 426-1102, for information and assistance.

Heavy canvas guards nylon line from heating torch in "heat and beat" operation.

Saved by the Master Plan!

By CAPT Donald A. Naples
USCG Station
Alexandria, Virginia

Introduction

Let's face it. Planning is a pain. Anyone who tells you different, either has a planning job somewhere—with not much else to worry about—or works for Civil Engineering.

Having taken the time to push through a Master Plan for Station Alexandria and using it to survive two audits this year, I'd like to share some of my experiences.

Background

Master Plans are relatively new. They've replaced the Unit Development Plans, which had been the Coast Guard standard planning documents for shore stations for many years.

The Shore Facilities Planning Manual (COMDTINST M11010.6) requires Master Plans for 14 large shore units, including the Coast Guard's seven Support Centers. These commands have no choice; they must have a Master Plan. This article is primarily aimed at shore units that are not required to have a plan.

Station Alexandria is typical of the latter group, with 200 acres of property and about 210 people assigned. All of our previous planning documents had been aimed at a specific goal such as justifying a new Admin/Galley/Barracks complex. We'd never made a complete assessment of the station. This is not an easy task, particularly for a 45-year-old unit with a multi-mission orientation.

In our case, the timing was ideal. The Department of Transportation (DOT) was looking at closing the station. (This happens about every 4 or 5 years, whenever new people come to the Office of Management and Budget or the DOT.) At the same time, Commandant (G-ECV) was looking for a sample Master Plan to provide as an appendix to the Shore Facilities Planning Manual.

Since we were coming under steadily increasing scrutiny, I volunteered to give it a try. I regretted that decision several times along the way, but now that it's done, I'm convinced we did the right thing. The job turned out to be more difficult than we'd thought. With the press of other business interfering, we didn't finish our plan in time to include it as a part of the planning manual.

Methodology

Space doesn't permit a lengthy discussion of the details, but what we did was conduct an in-depth resource and mission assessment with a view toward coordinated site development. Our site development to date had been totally uncoordinated and driven by short-term tasks and available funds.

We began by inventorying our facilities, equipment, and billets. This is the Resource Assessment, which includes identification of problem areas, development of alternatives, and recommended solutions. We also studied the local environment to develop a Vicinity Profile. We added a Site Analysis, which looked at utilities, slopes and soils, vegetation, and building constraints.

Using all this information, we drew up conceptual plans and developed an implementation plan to be completed in two phases over a 10-year period. Phase I (the first 5 years) is better defined than Phase II, but it all fits together.

Benefits

Was it worth it? Yes, yes, yes! Not a week goes by when I don't dig out the Master Plan—or send someone to check it—to make a decision or settle a discussion. The following are a few examples of how our Master Plan has helped us in its first few months of existence:

- When the General Services Administration (GSA) conducted a property utilization audit in April, it sent us a letter asking for information in 13 areas of interest. Our Master Plan had all but one of these areas covered. The only thing missing was an aerial photo of the station. What normally would have had us scurrying around for several days was provided in a few hours. The GSA auditors were so impressed with our Master Plan that they only spent 1 day on site and gave us a clean bill of health.

- In June, we got another letter, this one from the DOT Office of Inspector General (OIG). These people wanted to visit the station, spend "a couple of weeks" looking into our operation, and see whether any areas needed further auditing. Again, we trucked out our Master Plan and asked the DOT OIG staff to read it before coming on site. Doing this saved both sides days of discussion. We came out of the exercise with only three minor discrepancies but nothing requiring further audit.

- Several tenant activities are scheduled to move to the station next year, including a 490-foot relay tower being erected by the FBI and the U.S. Marshals Service Alexandria Field Office, which will shift its location to the station in mid-1986. Both of these projects are making improvements to the station, in accordance with developments described, but not funded, in the Master Plan.

- The Commandant decided recently that the Omega Navigation System Operations Detail (ONSOD) would move to Station Alexandria in 1986, rather than sometime in fiscal year 1989–93, as shown in our Master Plan. This caused a minor problem since the plot set aside for ONSOD would not be vacated in time to build a new facility on the site commencing in late 1985. Having the Master Plan as a ready reference made it easy to find a suitable alternate location.

Support

There's a sentence buried in the Shore Facilities Planning Manual that says Commandant assistance for preparation of Master Plans will normally be available on request. We could not have completed our plan without help from the Planning Section of the Civil Engineering Division in Headquarters. They gave us tremendous support. This included visiting, reviewing, suggesting changes and additions, providing guidance and liaison with Federal and county officials, and even drafting portions of the Site Analysis section. This is an outstanding resource, and it's available for the asking.

Conclusion

Writing a Master Plan is a lot of work, but it's well worth the effort. Take it from a convert who knows. Try it. You'll be glad you did!

Chief Engineer's Comments

Planning is becoming increasingly critical as we move further into a period of limited resource availability. As the resource base continues to shrink, the level of review and subsequent documentation required to justify, approve, and implement shore facility projects will continue to increase and intensify. Only those projects that can withstand the increase in scrutiny at all levels of the review process will be successful. Recent experience has shown the Master Planning Process is the best tool we have to insure early on in the resource acquisition process a thorough, objective, and coordinated identification of resource requirements, analysis of viable solutions, and justification of recommended shore facility projects. The Master Planning Process also provides a framework within which the often disparate, but equally important, needs of the field, district, and Headquarters-level activities can be fairly and adequately addressed. Because change is occurring faster than adequate instructions can be formulated, printed, and forwarded to the field, it has become more important than ever to seek early consultation with G-ECV master planning personnel. This early coordination offers the best opportunity for a successful conclusion to the long AC&I process by an early and timely formulation of a mutually acceptable and beneficial planning process.

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Engineering and Weapons Training: How It Can Work for You

CDR Fred L. Ames
Engineering and Weapons School
USCG Reserve Training Center
Yorktown, Virginia

Introduction

Before reporting to the Engineering School at the Reserve Training Center (RTC), Yorktown, VA, I knew very little about the school and even less about the Coast Guard's training system. I soon realized that even what little I knew was totally incorrect! Now, after being exposed to the many facets of Coast Guard training, I believe it's vitally important for everyone in the engineering and weapons community to understand how training can work for them. You will undoubtedly agree that training is an essential part of mission readiness, but do you really understand what Yorktown has to offer, or how the training system really works for you in the field? The Engineering and Weapons School can do a lot for you as I will explain later, but first, I will tell the story of where we have been, and where we are now.

History

Only recently has the Coast Guard been involved in engineering training in a big way. Before 1967, the Engineman (EN) Class "A" School was in Groton, CT, with boiler tenders (BT) and machinist mates (MM) attending Navy "A" courses. Through the 1950s and early 1960s, our cutter fleet consisted of WW II era ships, many with steam propulsion. In 1967, the EN Class "A" School moved to RTC Yorktown with the closing of the Groton Training Center. Nothing changed with the school, even though the fleet was making giant strides into current technology—with 210′ WMECs and 378′ WHECs. Gas turbine technology was introduced along with modern control systems. In 1971, the first two advanced courses were initiated: a Caterpillar diesel engine course for LORAN stations and an outboard motor course for small boat stations.

These two courses were highly successful in meeting the needs of the field, particularly training isolated duty engineers before they arrived at the LORAN stations and meeting an ever growing maintenance need at stations with the vast growth of outboard powered boats throughout the Coast Guard. Meanwhile, our new class type cutter engineers struggled to operate and maintain sophisticated equipment with the on-the-job training (OJT) school of hardknocks or the piecemeal commercial schools, some of which did more to advertise their equipment than teach anything. In 1974, another major change had further far-reaching effects on naval engineering. The EN, BT, and MM rates were combined into the machinery technician (MK) rating, which necessitated many revisions to the newly renamed MK Class "A" School. About that time, some very forward looking thinkers realized that the only way naval engineering would keep its new cutters going was to properly train its engineers. The current Navy courses often had information that did not apply to us, and some of the commercial courses contradicted with actual operations and mission requirements. Decisions had to be made to determine what and how to teach. A group of dedicated leading MKs and EMs produced the initial set of advanced engineering "C" courses after a great deal of hard work. The formal ceremony of 21 April 1978—where then RADM Stabile dedicated the advanced engineering classroom building at RTC—marked the new Engineering School, adding advanced training for MKs, EMs, and engineering officers to the four-year-old MK "A" course.

To improve "A" students' training environment and profit from commonality of training efficiencies, the decision was made to move the naval-engineering-related courses from New York TRACEN to Yorktown. On 1 January 1985, the school was renamed Engineering and Weapons School to include MK, EM, DC, GM, and FT ratings.

This fall, the Engineering and Weapons School became fully operational. This includes "A" courses for the MK, EM, DC, and GM ratings; 32 "C" courses; and the small arms instructor (SAI) course. This represents a staff of about 140 and a 4,000+ student throughput per year. Figure 1 illustrates the growth of the school since 1980. The latest addition to the school is the $3.5-million DC/Ordnance Laboratory, which adds 45,000 square feet, increasing RTC's total training space by 20 percent. A new Caterpillar/Outboard Laboratory will also be completed this year as well as an addition to the advanced engineering building for a big engine laboratory. (See figure 2.)

The last few years have seen the addition of five 270′ WMEC courses covering the fin stabilizer/CPP propeller, the machinery plant control and monitoring system (MPCMS), the waste heat recovery system/ship service diesel generator/evaporator, and the MK-29 gyrocompass. These courses benefit from multi-million dollar training aids; especially impressive are the fully operational waste heat recovery system and the simulator for the MPCMS console. Since the ships are minimally manned, these courses are designed for mandatory pipelining to specific billets. All personnel are completely trained prior to ever stepping aboard their new unit.

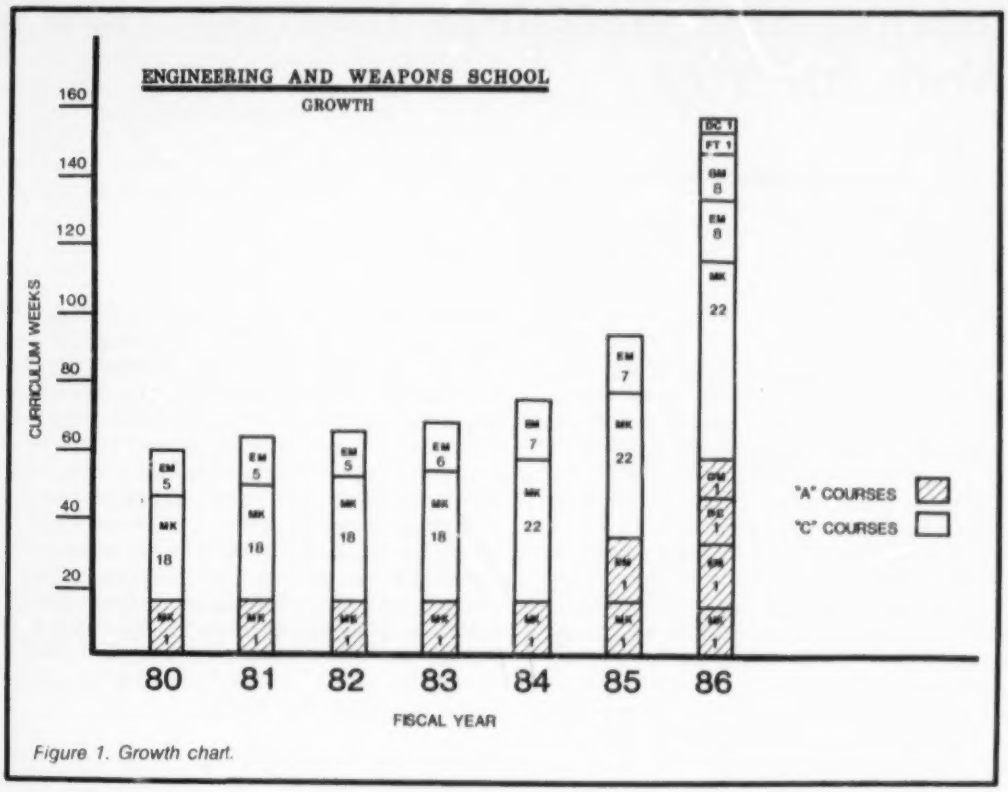

Figure 1. Growth chart.

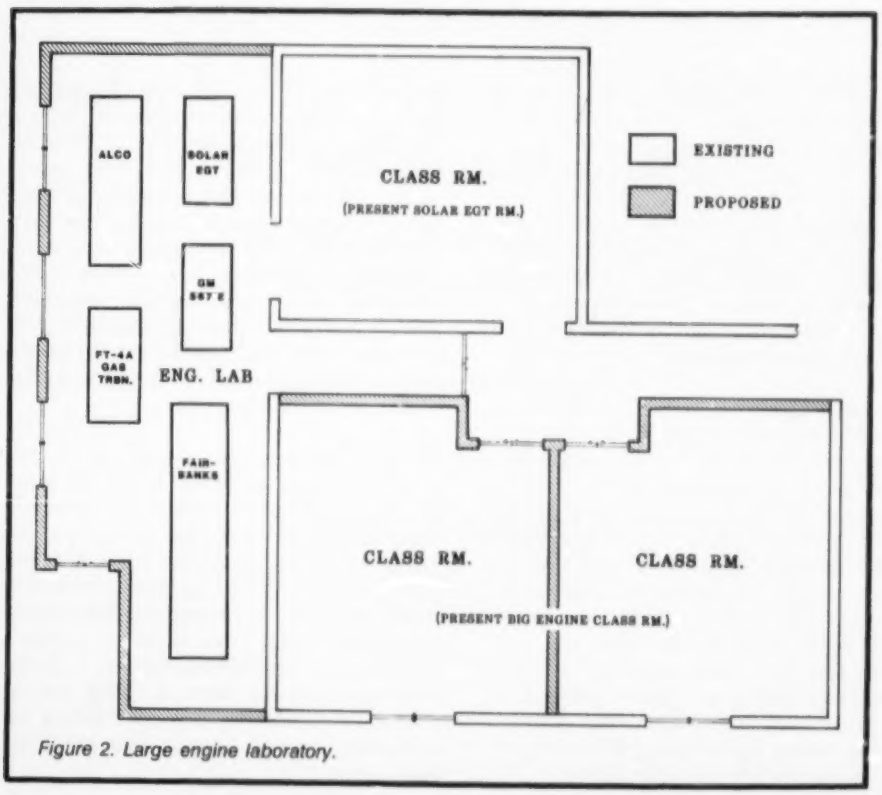

Figure 2. Large engine laboratory.

Training Development: An Overview

As trainers, we're constantly trying to increase the efficiency and effectiveness of our product. (Efficiency means minimizing the time and cost of teaching, and effectiveness means teaching the right things.) COMDTINST 1550.8B (Management of Training Courses and Resources) instituted a systems approach for course design called Instructional Systems Development (ISD). This was a decided departure from how the courses were originally developed, which essentially used a closed door panel of subject matter experts. (ISD is a process in which all steps needed for course development are identified and put together in a logical and systematic way—analysis, design, development, implementation, and evaluation. Each phase builds on the other to develop training that Coast Guard men and women use in performing their jobs.) The results, based on our experience with the eight courses reworked so far using this process, provide more instruction time on the essential, difficult tasks required in the field. Each of these tasks must also be tied to the Enlisted Qualification Manual. If they are not already identified as required skills in the manual, then they're added. In conjunction with this process, the courses are also being placed in Criterion Referenced Instruction (CRI) format. This format requires each learning objective to include a performance statement (what this skill is) and a description of the acceptable level of performance we expect of each student—how much, how many, how far, etc. Furthermore, the conditions under which the task is to be performed—given technical manuals, given special tools, from memory, etc.—are also stated.

Example of a Proper Objective

Given technical manuals and special tools, time a Fairbanks Morse diesel engine without error.

Skill. Time a Fairbanks Morse diesel engine.
Conditions. Given technical manuals and special tools.
Standard. Without error.

Note that these learning objectives should be those tasks/skills *you* agree need to be learned at the resident school.

Besides determining which skills should be taught, we are at the same time writing the actual test to be given to the students. We are trying to model the test as closely as possible to the real-world environment. I am sure you would agree with me that a 70 percent passing score on a multiple-choice quiz, on timing an engine, gives us no clue as to the competency/skill-level of the student. We want to observe the student actually performing the skills, whenever possible. In general, we are not educating for sometime in the future but providing increased skill levels for on-the-job performance now. Another way to look at this new instruction method is that we are purposely teaching to the test. Up front, we actually give the students the answers. For each learning objective, we provide background knowledge; discuss the required performance; demonstrate the performance; allow practice on the performance; and then finally, observe the performance/test.

Something very interesting to note in writing these objectives is that they also define the training aids required. As in the prior example, a Fairbanks Morse diesel engine must be available for the students to demonstrate timing skill.

The Training System

How does this all fit together, and where are you in the training system?

First, please answer the following questions, true or false?

- Training schools exist to take on the accountability for seeing that our petty officers get the training they need.

- Training schools should be accountable for seeing that every petty officer knows the job thoroughly.

- One accountability of a training school should be in the identification of needs that operating engineers have not yet recognized and the mounting of training efforts to satisfy these needs.

The answer to each is false! Figure 3 is what I call "training bridges." We start in the upper, left-hand corner with qualified trainees. How are they qualified? They are supposed to have the basic knowledge, skills, and experience to successfully complete the training (master the new skills). Who determines if the individual is a qualified trainee? You do! This is done by evaluating the individual's on-the-job performance, the previous duty assignments, and checking out the Commandant's required prerequisites. Therefore, you, as a supervisor, are accountable to send us willing and able students. I just told you how able is determined but, how about willing? The most qualified trainee, if he or she doesn't want to learn, simply won't. You must clearly indicate to your prospective student how he or she will use the newly acquired skills upon returning to the unit and the benefits to both them and the Coast Guard. I strongly suggest that the supervisor sit down and explain these facts. In other words, sell the prospective student to buy in to what the school offers.

The first "bridge" we come to is the training class where we, the school, are accountable to deliver on our promise to increase the skill level of the student.

One of the ways we determine if our training class is effective is to ask the students, by way of critique sheets and feedback, during class. In that way, we monitor the quality of our instructors, training aids, organization of material, adequate time, training environment, etc.

Hopefully—if we did our job at the school correctly—out comes a set of trained folks. These individuals now return to their units where the most critical bridge is placed before them. Unless these trained folks are

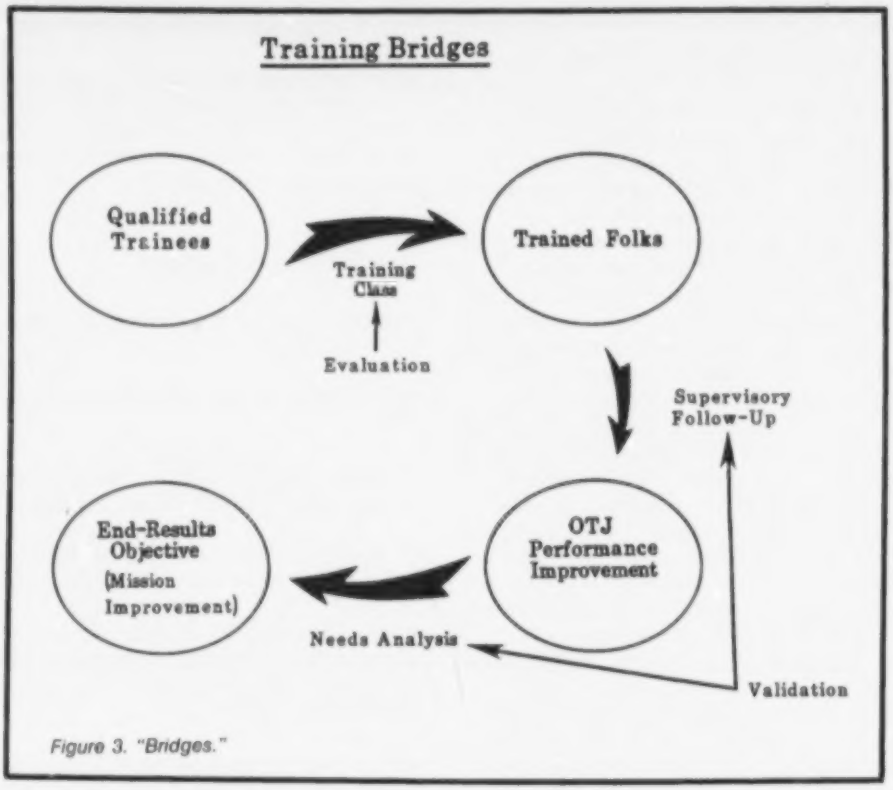

Figure 3. "Bridges."

permitted to work on the equipment/systems on which they were trained, to the level they were trained, with the methods they learned, and given supervisory support in all these areas, all training will be for naught! The half-life of training or education is very short! In other words, use it or lose it! For you EOs and EPOs, send us those who will be assigned primary duties for the equipment; and when they return, let them do the job, and evaluate them carefully on their performance. For instance, don't be so quick to call a technical representative for that MK27 gyrocompass. Try out the electrician's mate you sent to school. You may be delightfully surprised. Also remember that your trained folks have learned it and demonstrated it once or twice in a classroom environment. Considerable follow-on training on the job may be necessary. This again is the supervisor's responsibility.

If we cross over this bridge, we should begin to see performance improve on the job. Is this the end? No way! Just because the engineer performs his or her job better doesn't necessarily solve the real problem. We must cross another very important bridge to reach the end-results objective: *mission improvement.* For instance, we should now expect less casualties, better performance, more reliability, etc., from our equipment. But, do we get these final results? No matter how well we did all the other jobs in the training system, if we did not properly determine what the real training needs are, we are attempting to solve the wrong problem. It is important to note that we are really asking the field: "where do you need training?" It is you the operating engineer who should be able to tell us where the skill deficiencies exist. We must focus our attention on these skill deficiencies here at the school. If a piece of machinery is unreliable due to faulty parts, all the training in the world will not solve this problem. While this example may be rather obvious and simple, there are many other problems which "get them some training" is often jumped at without carefully analyzing the real problem. It must be a human-performance-related problem that is solvable by training. If the performance gap is due to lack of motivation, again, training is not the answer. This brings in a most important tool in this entire process: validation. We must rely on you the operating engineer to look carefully at the "supervisory bridge" and the "needs bridge," and let us know about the field problems. For you supervisors, let us know if we are teaching the wrong things, not enough of the right things—or not at all—or if they could be taught more effectively somewhere else—on the job. For you engineer officers and group engineers (EPOs), let your district naval engineer and us know of your engineering problems, especially those which appear to be training related. This is an open plea for communication between the field, the districts, and us. We must know what is happening out there so we can do our job: delivering training that works.

Recent Changes in Response to the ISD Process

What are some of the changes you'll see in the engineering courses in fiscal year 1986 as we move to increase efficiency and effectiveness?

MK-3, 378' WHEC Solar T-1000 Emergency Gas Turbine Generator. Will be combined with MK-4, Pratt and Whitney FT4A, to form the new gas turbine course.

MK-15, 378' WHEC LM-100 Emergency Gas Turbine Generator. Will be dropped in response to FRAM changes. In this format, gas turbine principles only need to be taught once. Furthermore, this eliminates return trips to Yorktown.

MK-12, Caterpillar 333/343 Diesel Engines. Will be combined with MK-24, large Caterpillars, into one generic 2½-week Caterpillar course covering all models. We intend to provide sufficient types of engines in the new building to present students practical training on a model the same as or very similar to their own unit. Instruction on the electrical end has been deleted and practical training added on inspecting accessory drive trains, crank web deflections, turbo thrust readings, and use of service literature and microfilm library.

MK-22, Refrigeration and Air Conditioning. Changes from a 6-week to a 6½ week format, providing increased practical testing on a wider variety of actual systems and trainers, including multibox refrigeration and associated electrical systems, shipboard water chiller unit and HVAC systems, adjustment of thermostatic expansion valves, and detecting leaks and repair on system mock-ups.

MK-23, Outboards. Changed from a 2-week tear down and rebuild to a 1-week maintenance, tune-up and troubleshooting course to coincide better with the actual tasks in the field.

MK-5, Boilers, Water Testing, and Evaporators. Will be broken up into two 1-week courses instead of one 2-week course. One will cover the Johnston Boiler, water testing and Cuno evaporator for 378' WHECs, and the other the Waywolff Boiler, water testings and initial Cuno, and later METCO evaporators for the 210' WMECs. Smaller cutters with Waywolff would also attend the latter course.

Current Major Initiatives

The following projects are part of our quest to better meet your needs:

Task Analysis. A panel of 10 MKs convened at Yorktown in January 1985 under the auspices of G-PTE and G-ENE. They were selected from the field and school to provide experience from all sizes and types of cutters, stations, and boats. The panel spent 2 weeks writing down every task that MKs perform. This listing will become the basis for a Coast Guard-wide field survey this year to determine who—at which units and what grade level—perform the task, and whether or not they actually perform the task or supervise it. The results will provide a completely new set of qualifications, much more definitive than those present. The intent is to better qualify our engineers for rate through a qualification system placed squarely on the shoulders of the supervisors, in lieu of simply a correspondence course system. The MK "A" course will be completely revised, based on these results. Many of the tasks of "C" schools will be separated out of the basic rating qualification and tied to a school code. For instance, gas turbines are only on 14 vessels. Since every MK should have some basic generic knowledge of gas turbines, training and hence, qualification of the hard skills will be in the "C" course. We are also attempting to work closer with the Institute to make the correspondence courses and the resident training more compatible. Major revisions of both may be necessary after the qualifications are rewritten. A similar task analysis process is currently underway for the EM rating.

Exportable/Dockside Training. Promulgation of the Cutter Training and Qualification Manual (COMDTINST M3502.4A) along with recent emphasis on budget reductions and personnel cuts have provided both a dilemma and an opportunity. The dilemma is that operational units are under the gun to send their people to resident training courses, while the training system is being told to reduce both quota offerings and funds necessary to send these people to the schools. RTC is going forth with a test program to provide both exportable and dockside training *whenever* instructor resources are available. (Exportable means we send qualified instructors with course materials out to your unit. Dockside means here at RTC for East Coast cutters either passing by or in conjunction with scheduled Navy training availability.) In the past, we have routinely supplied exportable engineering training to Ninth District gatherings of 180' WLBs and 140' WTGBs. Our current proposed program includes the following:

- Providing engineering courses tailored to the specific class cutter.
- Encouraging cutters to hold dockside training availabilities at Yorktown with access to our classrooms and the nonportable training aids.
- Advocating districts to arrange local gatherings of class cutters with exportable training provided by us. When ASSIST/MAT team personnel are included, this training mode is especially advantageous.

The test program is forthcoming from COMLANTAREA(Ar). We are ready now to field specific requests from any district or cutter, East or West Coast. Instructor TAD costs for exportable training will be area funded. Table 1 lists the engineering and operations courses we currently provide. Furthermore, special training such as a 1-week generic hydraulics troubleshooting course for senior MKs and GMs; a specific main propulsion overhaul course designed for team training; and miniteam training for repair parties, i.e., shore a hatch, and gun crew training for the 5- and 3-inch mounts are examples of the multitude of things we can offer. The bottom line is: "Ask us."

Technical Assistance. Because we have the greatest cadre of engineering and weapons technical expertise

Training Available

Engineering:

Name	Number	Duration (Days)	Export-able?
JP–5 Aviation Fuels System	J-651-0466 or MK-22	1½	Yes
Synchro AMPS/MK-27 Gyro	EM-20	4	No
Gyrocompass MK-29	EM-26	5	No
Engineer Officer/ Main Propulsion Assistant Indoc	EO-16	5	Yes
Fuel Handling/Oily Water Separator	MK-2	3	Yes
Solar T-1000s Emergency Gas Turbine	MK-3	3	Yes
Pratt and Whitney FT4A Gas Turbine	MK-4	5	Yes
Engine Governors	MK-7	2	No
FM 3800 Series Diesels	MK-8	5	Yes
CPP Systems (Less 270)	MK-9	1	Yes
378 Control Systems	EM-18	2½	Yes
ALCO 251 Diesels	MK-11	5	Yes
CAT Diesels	MK-12 MK-24	4	Yes
210 "B" Control Systems	MK-13	4	No
GM 8-567E2 Diesels or EMD for WLB	MK-14	3	Yes
GE LM-100 Emergency Gas Turbine	MK-15	3	Yes
Emergency Gas Turbine Controls	EM-19	3	Yes
Generator/Steam Generator/Oily Water Separator Controls	EM-21	4	Yes

Engineering:

Name	Number	Duration (Days)	Export-able?
Outboard Motor Maintenance and Troubleshooting	MK-23	3	Yes
Fire Tube Boiler/ Flash Evap Ops & Maint	MK-5	3	Yes
270' S/S Generator, Waste Heat Recovery System and Evaporator	MK-27	5	Yes
270' CPP and FIN Stabilizer Systems	MK-28	5	Yes
270' Main Propulsion Control and Monitoring System	MK-29	5	Yes

Operations:

Name	Number	Duration (Days)	Export-able?
Navigation—Piloting Refresher	J-2G-0602	5	Yes
Rules of the Road W/Exam	Various	5	Yes
Radar Navigation Team Training	Various	5	No
Navigation—Celestial Refresher	J-2G-0603	5	Yes
Navigation Officer	J-2G-0616 or J-2G-0618	12	No
OOD/JOOD Procedures	J-2G-0605	5	No
Rapid Radar Plotting	Various	5	No
CIC Plotting Procedures—Basic	J-221-0300	5	No
Lookout Training	J-000-0621	1	Yes

Table 1.

under one roof in the Coast Guard, we can and have provided all types of technical assistance to the field. We encourage our former students—or anyone for that matter—to contact our instructors when they have particularly perplexing problems. This also helps keep us current with the real world, thereby enhancing our classroom instruction. We can also build exportable training around your technical problem and perform three functions: solve your operating problem, train your people, and keep ourselves abreast. Also included in this area is assistance to COMDT(G-ENE) and District Naval Engineering in solving class problems and prototyping changes on our training aids. For instance, we are working on the interface of the C3 with the 270' WMEC control console, replacing the printer, dual tape drive (trend analysis data), and keypad with C3 equipment.

Commonality of "A" Courses. Each of our four "A" courses (MK, EM, DC, and GM) provides basic knowledge and skills in electricity, hand tools, mathematics, hydraulics, blueprints, portable pumps, and firefighting equipment. Common curricula should provide a consistent level of training for each of these four rates; reduce separate curricula, lesson plans, handouts' and tests' development and maintenance; and provide efficiencies in instructor billets—if we can teach the same lesson to more than one class at a time.

Further Training Aid Acquisitions. With the move to CRI, we established the need for complete ALCO and Fairbanks Morse diesel engines. A large engine laboratory will be built to house these two engines, a newly reconditioned FT4A gas turbine, and the 378' WHEC S/S diesel and emergency gas turbine generators (GM567E and Solar) respectively. In the future, we will obtain one of the new 378' WHEC control consoles from the FRAM project and procure an associated simulator. A single point davit for the hydraulics laboratory is in the works as is a fin stabilizer training aid (electronic portion) for the 270' WMEC. The largest acquisition on the horizon is the MK-92 gun fire control system (GFCS) and eventually, the MK-75 70-mm gun—presently on the 270s and to be placed on the 378s during FRAM. The new DC/Ordnance Laboratory is initially housing the MK-56 GFCS and 5"/38 gun with room allocated for this new weapons system. These weapons' acquisitions will enable the Coast Guard to control its own FT training, making it applicable to the Coast Guard's particular equipment MOD along with a definite reduction in length from the present Navy course. Future procurements of a CUMMINS 1710 and a Caterpillar D398 are also under consideration.

Practical Considerations

Of more practical concern to the operating engineer is: how do you get the right people trained, and how are quotas managed? The entire training process begins with your review of the Cutter Training and Qualification Manual (COMDTINST M3502.4A), the Training and Education Manual (COMDTINST M1500.10A), and your current and future personnel picture. M3502.4A specifies exactly how many trained folks you need and in which courses. M1500.10A provides guidance on course description, duration, location, eligibility/prerequisites, and most important, how to complete the Short-Term Resident Training Request (CG-5223). It is critical that this training request be properly completed, explaining in detail all special needs in block 18. Pertinent information would be requests for eligibility/prerequisite waivers; transfer of prior trained individuals; special missions forthcoming requiring more training than M3502.4A specifies; why only a specific class convening is acceptable, etc. The number of personnel onboard already trained by a specific "C" school is vital information and must be included. The bottom line is: "Communicate your needs." This form is sent to G-PTE, who in turn provides it to G-ENE-2A, Naval Engineering's Training and Personnel Assistant, presently LCDR Dick Carter, FTS 426-1189. He is the one who balances your unit's needs against all the others when allocating limited quotas. Hence, it is of importance that you submit a properly documented CG-5223. Furthermore, he makes the decision on waiver requests. Our training concept is for our senior enlisted personnel to receive the training and impart their knowledge to the junior personnel. This is where we can get the most return on our investment of limited training dollars. However, G-ENE will entertain good and sufficient eligibility waiver requests when personnel shortages occur and junior personnel are assigned to senior billets. The remarks section must indicate that the petty officer, who does not meet the eligibility requirements, requires the training to fulfill the skill requirements of his or her billet. Should you request a quota with eligibility waiver by message, please inform RTC.

Lastly, your careful evaluation of the M3502.4A requirements and personnel picture should minimize G-PTE issuing select and direct type quotas. We ask you to faithfully adhere to the specified formal school requirements and to predesignate individuals, or at least the billet (for incoming personnel), that will fill the quota. This is simply good personnel management practice.

Conclusion

This quick sketch should provide you with an insight into how we, at Yorktown, are attempting to meet your needs. Let me summarize:

- The training system exists for one reason only: to support you as an operating engineer, bridging the gap of skill deficiencies.
- We are responsible for providing increased skills to those who come here to school.
- You are responsible for selecting the right people for training, effectively supervising them upon their return, and letting them do the job for which they were trained.
- Furthermore, you must communicate to us when we are not teaching the correct skills or not teaching them effectively.

GM2 Goodwin keeping the student on target at the small-arms range.

- Finally, there must be an information flow between the field and the school to help us understand your problems and to assist in developing the fix where maybe training is the answer.

Our goal is: "delivering training that works." Please help us meet that objective.

About the Author

A 1968 Coast Guard Academy graduate, CDR Ames is presently the Chief, Engineering and Weapons School, Reserve Training Center, Yorktown. He served 7 years on 378' WHECs in assignments including DWO, ASWO, EO, and XO. Ashore, CDR Ames served in the Third District Naval Engineering as Assistant Branch Chief and RIO Tacoma as Chief, Technical Division for the 140' WTGBs and 270' WMECs. He is a graduate engineer from MIT and has a Master of Science degree in management. CDR Ames is a registered Professional Engineer in mechanical engineering, and naval architecture and marine engineering.

Chief Engineer's Comments

The Engineering and Weapons School continues to do a tremendous job by providing an excellent service to the Coast Guard community. The school is developing proposals that, if approved, will enable it to provide Damage Control and Weapons Training currently provided by the Navy training system.

A large number of training quotas continue to be cancelled after a tono, based on the unit training request, is issued. Proper planning will avoid the problems and waste that cancellations create. Support the system by selecting the right people for the right training, and then, send them as planned.

FT1 Humphries installs MK-56 GFCS equipment.

Major Disaster Averted in the Gulf of Mexico

Reprinted, with permission, from *Proceedings of the Marine Safety Council* July/August 1985.

By LTJG Robert E. Acker
Port Safety Detachment
Morgan City, Louisiana

Introduction

On September 7, 1984, the McDermott Derrick Barge No. 16 was offshore in the Gulf of Mexico at Block 20-A, Mississippi Canyon. The vessel is a 400' nonself-propelled, 7,846 gross ton, steel industrial vessel built in 1967 at Orange, Texas. (See figure 1.) The vessel was working for SOHIO at the time of the incident and was standing by waiting for the weather to improve. The wind was from the east at about 18 knots with 6- to 8-foot seas.

The Accident

At approximately 1500, the vessel took a heavy roll. Soon after, smoke was discovered in the passageway below the circular space beneath the crane at the main deck known as the gantry tub. The shift welder reported the smoke to the shift engineer, who in turn sounded the general alarm. Personnel aboard mustered topside with the person-in-charge confirming the roll call. All persons were accounted for. The Coast Guard was notified by nearby McDermott Derrick Barge No. 22, and as the firefighting efforts began, 31 persons were evacuated via company helicopters.

The chief engineer was in charge of the damage party fighting the fire. He and the first assistant engineer each donned a self-contained breathing apparatus, gear required in the complement of fully outfitted fireman's suits aboard large merchant vessels. They proceeded immediately to the third-level generator room and tripped the generators off the line by closing fuel valves. Working in thick smoke, they started the diesel-driven fire pump in the space opposite the generator room. After verifying that the pump was taking suction, they proceeded upward to the base of the ladder to the gantry tub (see figure 2) before being driven back by the heat. They managed to secure the watertight door to the machine shop, preventing the blaze from spreading any further aft. Retreating forward, they secured each watertight door as they passed through.

The paramount concern during the firefighting was to extinguish the blaze before the fuel tanks adjacent to the passageway below the gantry tub ruptured. On deck, the rigger foreman had his men take out fire hoses and secure watertight doors and ventilation closures. They also secured all forced draft ventilation and air conditioners from remotely mounted electrical shutdowns on the main deck. They hooked up a three-cylinder lifter pump kept aboard for dewatering and, taking suction from a ballast tank, commenced cooling the port and starboard fuel tanktops. The towing vessel JARAMAC €2 assisted by providing additional cooling water to the base of the crane.

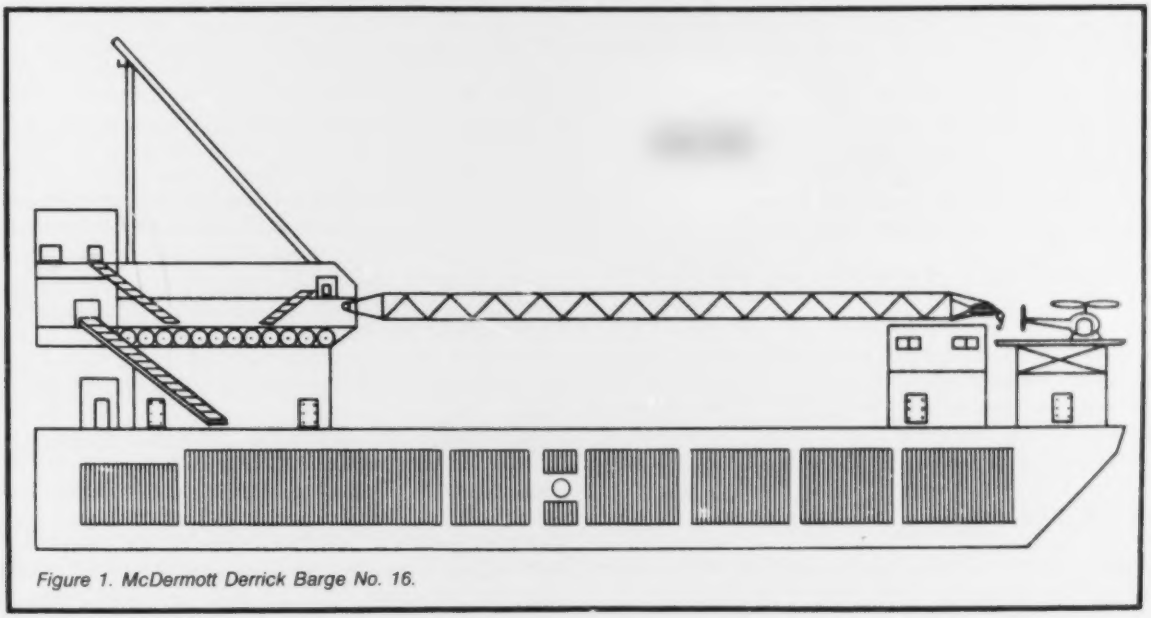

Figure 1. McDermott Derrick Barge No. 16.

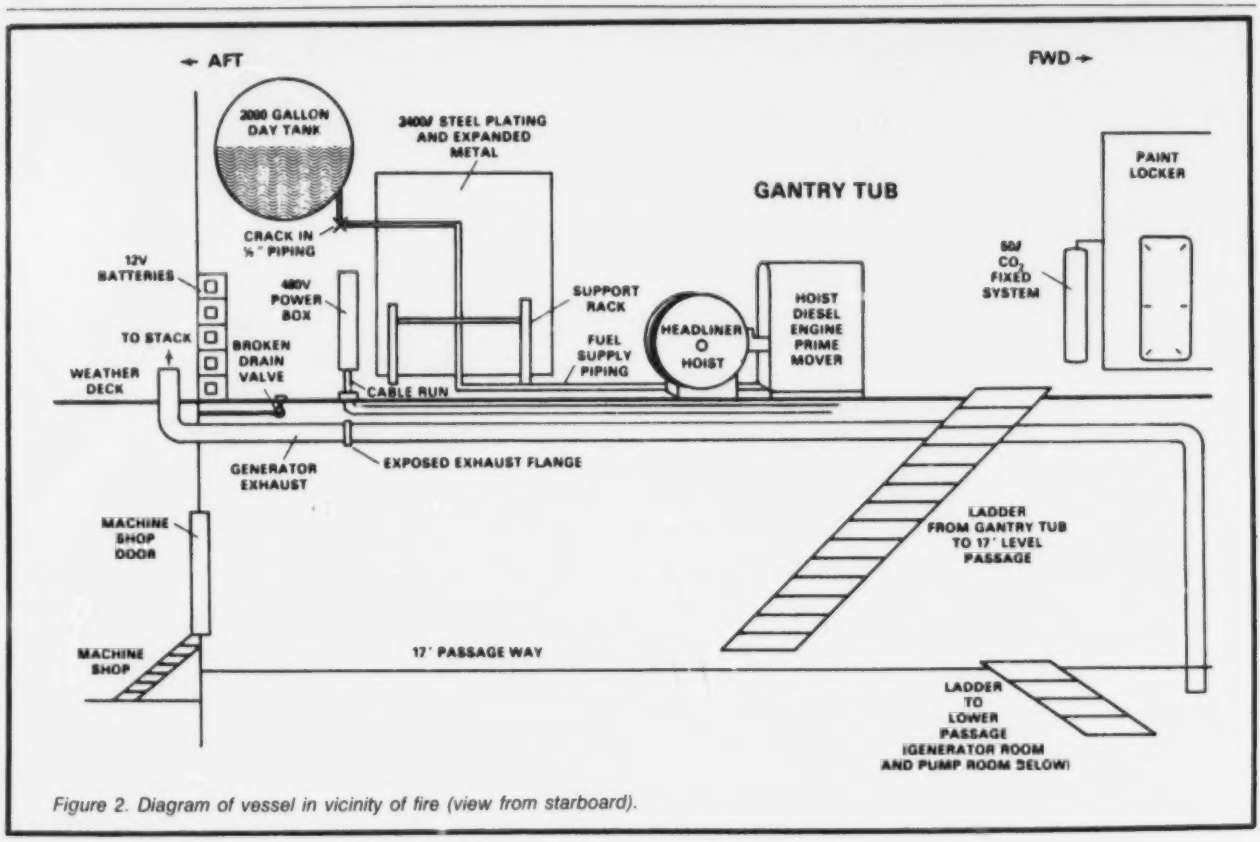

Figure 2. Diagram of vessel in vicinity of fire (view from starboard).

The firefighting was conducted in exemplary fashion. The crew gathered dry chemical portable extinguishers from throughout the vessel to the weatherdeck aft of the gantry tub. They discharged the agent into the gantry tub through a cable-run collar while injecting firefighting water through a vent to a particularly hot area near a series of welding machines within. Meanwhile, the chief engineer entered the gantry tub through a forward watertight door and released carbon dioxide from the 50-pound fixed system into the paint locker. Flames and smoke were pervasive in the passageway below the gantry tub, with the most intense heat radiating from the overhead corner opposite the watertight door to the machine shop. The combined effect of dry chemical and firefighting water reduced the heat sufficiently so that firefighters could enter the area where smoke was first sighted. The fire was extinguished at 1715.

Inspections were made of the areas near the fire until about 1930, during which time water was continually applied for further cooling. With a reflash watch on station, the crew reopened fittings and watertight doors to eliminate smoke. Overhaul and dewatering in the gantry tub and passageway below followed as the vessel began transit to McDermott Pipeline Yard, Amelia, Louisiana, in tow of M/V GULF CAJUN.

The Investigation

Investigation of the incident began after the vessel was moored on September 9, 1984. The chief engineer, person-in-charge, first assistant, and shift welder were all questioned as reconstruction of the fire began. Examination confirmed that the two areas primarily affected by the blaze were the lower passageway aft below the gantry tub and the gantry tub itself. The first engineer indicated that most of the heat had been concentrated at the lower passageway above dual exhaust pipes from the Waukesha L-5790D diesel generators. At the time of the fire, the generators were working at full load, with the pyrometers reading 750°–900°F. Visual examination confirmed that much heat had been concentrated at this location. The heat and smoke patterns left color evidence of intense heat above the watertight door to the machine shop. The electrical cables overhead were charred in this vicinity, while further forward they were primarily melted. The cables entered the space through the overhead. It was noted that there was a cracked drain valve directly above the cable run. This drain appeared to be full of oil debris. Fuel tanks were located adjacent to the passageway. There was no apparent damage to the inboard side of the starboard tank, but the upper 2 feet of port inboard bulkhead was buckled in the corner above the generator exhaust where the fire appeared greatest.

Examination of the gantry tub followed. Damage was concentrated in the area aft of a GM 6-71 diesel-driven headliner hoist. This piece of gear took suction of its fuel supply from a 2000-gallon diesel fuel day tank mounted at the aft bulkhead approximately 10 feet above the hoist. Several welding machines were located nearby. Aft of the headliner hoist, several 12-volt batteries were

stored, though none were trickle-charging at the time of the incident. A rack of one-eighth steel plating and expanded metal weighing approximately 2,400 pounds was lying against the port side of the headliner hoist. Two 480-volt panelboards were also located aft of the hoist. The paint locker was located further forward. Examination revealed that the fixed carbon dioxide had been discharged into the locker with no evidence of damage within. Securing the cover to the paint locker had prevented the extinguishing agent from escaping the space. Quick release of carbon dioxide probably prevented the paint locker bulkheads from reaching high temperatures. With paint ruled out as a source of combustion, attention was directed to the fuel day tank supply for the headliner hoist. The tank, which was built in 1966, showed no evidence of rupture. However, the half-inch mild steel supply piping to the hoist engine was cracked at a union joint directly above the one at the 480-volt panelboards. This panelboard showed little evidence of damage within, so it was doubtful that ignition of the fuel had originated there.

When the lower passageway was re-examined, investigators discovered an exposed exhaust flange located directly beneath the cable run through the deck from the 480-volt panelboard. Close examination of the insulation blanket, which appeared to be protecting the steel exhaust flange, revealed a 2-inch gap of exposed metal between the wire lacings directly beneath the overhead panelboard. Since number two diesel fuel has an ignition temperature of about 500°F, the temperature of the hot exhaust piping with gases between 750–900°F was more than sufficient as an ignition source.

Conclusion

A heavy roll of the vessel at about 1500 on September 7, 1984, caused a rack supporting 2,400 pounds of steel plating and expanded metal to collapse. The plating fell against a half-inch fuel supply pipe, cracking it, and allowing as much as 1,000 gallons of diesel fuel to spill on the deck. Some of the fuel passed through a cable run in the deck, falling directly atop hot exhaust piping. This fuel ignited.

Several lessons in fire prevention are evident from this incident:

- Equipment and gear aboard vessels should be properly secured for sea. Had the stack of steel plating been secure and unable to move, the piping would probably not have been cracked.
- Fuel piping should be properly supported and located for maximum protection from its surroundings.
- Cable penetrations through bulkheads and decks should be made through stuffing tubes to provide maximum watertight protection, and to prevent the spread of flood and fire. Newer industrial vessels are constructed to meet this standard.
- Exhaust piping insulation should receive proper attention and maintenance.
- Ever present high exhaust temperatures are a proven fire hazard. Foresight and attention to detail by crew members could have prevented this incident.

Damage was approximately $270,000. If not for the prompt detection of the fire and firefighting response by the crew of the McDermott Derrick Barge No. 16, the port fuel tank adjacent to the lower passageway would have ruptured, and the contents of the temporarily inserted paint locker would have ignited. The result would have been a disaster of great magnitude with injury and loss of life.

About the Author

LTJG Robert E. Acker is one of nine marine inspectors assigned to Marine Inspection Detachment Morgan City, LA. After graduating from the U.S. Coast Guard Academy in 1980 with a Bachelor of Science degree in management, he spent 2 years as a shipboard engineer aboard USCGC Sherman *(WHEC-720). LTJG Acker was the Coast Guard investigating officer assigned for the McDermott Derrick Barge No. 16 incident.*

Chief Engineer's Comments

This article should be of general interest to Coast Guard members responsible for safety and fire protection aboard our cutters. It may be useful to review and note the conclusions of the author for use during safety and material inspections.

The firefighting procedure used on the McDermott Derrick Barge No. 16 represents one option, as applied to this particular incident, and should not be considered as the best or only method of fighting a "below decks" class bravo fire. Firefighting procedures aboard cutters should continue to incorporate the training and information provided by the fleet training groups, naval ships technical manuals, repair party manuals, and Coast Guard directives that address fire at sea.

Engineer's Digest Questionnaire. Cut out or make copy, fill in blanks, and return to: Editor, **Engineer's Digest**, G-Eg/Rm. 6200, U.S. Coast Guard Headquarters, 2100 2nd St., S.W., Washington, D.C. 20593.

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_____

Editor's Notes

- Recent comments from our readers indicate that we may have given an "erroneous impression" in our Fall 1985/Winter 1986 issue. Specifically, on page 3, we encouraged each engineering employee to become a member of a professional engineering society; however, the list we published was *representative* and was not meant to be an endorsement of only certain societies. We apologize for the misunderstanding.

- Also, on page 9, we wanted to give "just due" credit to the R&D Center for supporting the A/N mission and G-EOE's needs with ongoing testing and evaluation of existing and candidate hardware and systems. The R&D Center views this work as one of its more important missions.

Do You Have a Story to Tell or a Question to Ask?

Do you have a new idea or technique? Send it in to the Editor, **Engineer's Digest,** Coast Guard Headquarters, Washington, D.C. 20593, so that it can be published for the benefit of others. If you have a question you'd like answered about a specific problem, send it to the Editor, and she'll publish the best answers available at Headquarters.

The **Digest** can better serve your needs if you send in your ideas, your questions, or your comments for publication.

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CG-133

Chief, Office of Engineering
RADM K. G. Wiman
Deputy Chief, Office of Engineering
CAPT D. L. Hoffer
Editor
Annette M. Nieves

The Coast Guard **Engineer's Digest** is an official publication of the Office of Engineering, U.S. Coast Guard Headquarters, Washington, D.C. Now published quarterly, the **Digest** has been a medium for communicating new ideas and technology of interest to Coast Guard engineers since April 1933.

The **Digest** is a professional journal for the publication of general interest articles and studies aimed at sharing lessons learned and advancing engineering in the Coast Guard. Articles will be published based upon their audience in the general readership, the appropriate reviewer's recommendation, the timeliness, and the quantity and types of articles available.

While some material for the **Digest** is reprinted from other technical publications, most papers are submitted from the field by Coast Guard engineers and engineering managers, both military and civilian.

The Office of Engineering encourages all Coast Guard personnel in engineering-related fields to share their ideas, experiences, successes, and failures with the Coast Guard engineering community by submitting articles and papers for publication in the **Digest**.

Observe the following guidelines when submitting material for publication:

- Manuscripts should be typed double spaced on one side of 8½ x 11-inch white paper, leaving at least a 1-inch margin on all sides.
- Original articles by Coast Guard personnel (civilian and military) should have a byline, giving name, title, and unit, and a short biography of the author.
- Illustrations—glossy black and white photographs or line drawings—should be approximately 8 x 10 inches in size. In cases where the author does not have adequate facilities for producing finished art, the **Digest** can have artwork made up from the sketches.
- Complete figure captions and figure numbers should be listed on a separate sheet of paper or taped to the back of each illustration. Do not use staples or paper clips on photographs. Protect illustrations for mailing by placing them between pieces of stiff cardboard.

Send articles (original and one copy), letters, photographs, suggestions, etc., to:

Editor, **Engineer's Digest** (G-Eg/62)
U.S. Coast Guard Headquarters
2100 Second Street, S.W.
Washington, DC. 20593

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This publication is intended for all hands. Commanding Officers should take the necessary steps to make it available to all military and civilian personnel within their commands.

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From the Editor

Dear Readers:

We live in a world of change, yet we plan and act on the basis of continuity. I have experienced a number of changes in my own career as editor. With the new Commandant coming on board this summer, Coast Guard employees did not only anticipate change but expected it in their business lives. The **Digest** is not immune to change (as you may have noticed from recent issues). In this issue, I intend to announce some policy changes that will affect the future direction of the **Digest**.

The **Digest** has been a professional journal for the publication of research papers, special studies, and general interest articles aimed at advancing engineering in the Coast Guard. Now, the **Digest** will be a professional journal for the publication of general interest articles and studies aimed at sharing lessons learned and advancing engineering in the Coast Guard. Articles will be published based upon their audience in the general readership, the appropriate reviewer's recommendation, the timeliness, and the quantity and types of articles available. (See cover 2.)

As you may have guessed by now, the theme for this issue of the **Digest** is change. Changes occur constantly. By mastering change, we can make it work for us, not against us; and by doing so, we will be better prepared for the future. I hope you try to identify what changes seem to be occurring in engineering-related fields; please let me know (that would be a pleasant change).

Annette

Engineering News

Revisions of Qual Codes

The qualifications (qual) codes for MK, EM, and DC have undergone major revisions. Change I to COMDTINST M1414.8A (Enlisted Qualifications Manual) updates the eligibility requirements and code titles for qual codes. (See ALDIST 055/86 DTG R211420Z MAR 86 for effective dates and specific instructions.) The enlisted engineers' service records should be updated with the new qual codes through Personnel Management Information System (PMIS) documentation. Follow up, and see that it gets done!

4,500 PSI SCBA Cylinder Fill Hose Assembly

Coast Guard units that use 4,500 PSI SCBAs (pounds per square inch, self-contained breathing apparatus) and have trouble finding local sources for refills because the local dive shops and fire stations do not have the correct fittings on their fill hoses can overcome this problem by purchasing a fill hose adapter from U.S. Divers Corp. in Santa Ana, CA. This solution was suggested by MK1 Baldridge of Station Port Isabel, TX.

The fill hose assembly (U.S. Divers part number 930103) costs $165 and can be ordered directly from U.S. Divers Corp. at the following address:

U.S. Divers Corp.
3323 West Warner Avenue
Santa Ana, CA 92702

Further information on the fill hose can be obtained by calling Mr. Gary Lee of U.S. Divers at (714) 540-8010.

Commandant (G-EOE) will publish safety information and Preventive Maintenance System (PMS) guidance for the fill hose.

Coatings and Color Manual

Change 2 of the Coatings and Color Manual (COMDTINST M10360.3) was issued during the third quarter of fiscal year 1986. This change, a major revision, eliminates lead-based paints and reduces the use of chromate pigments.

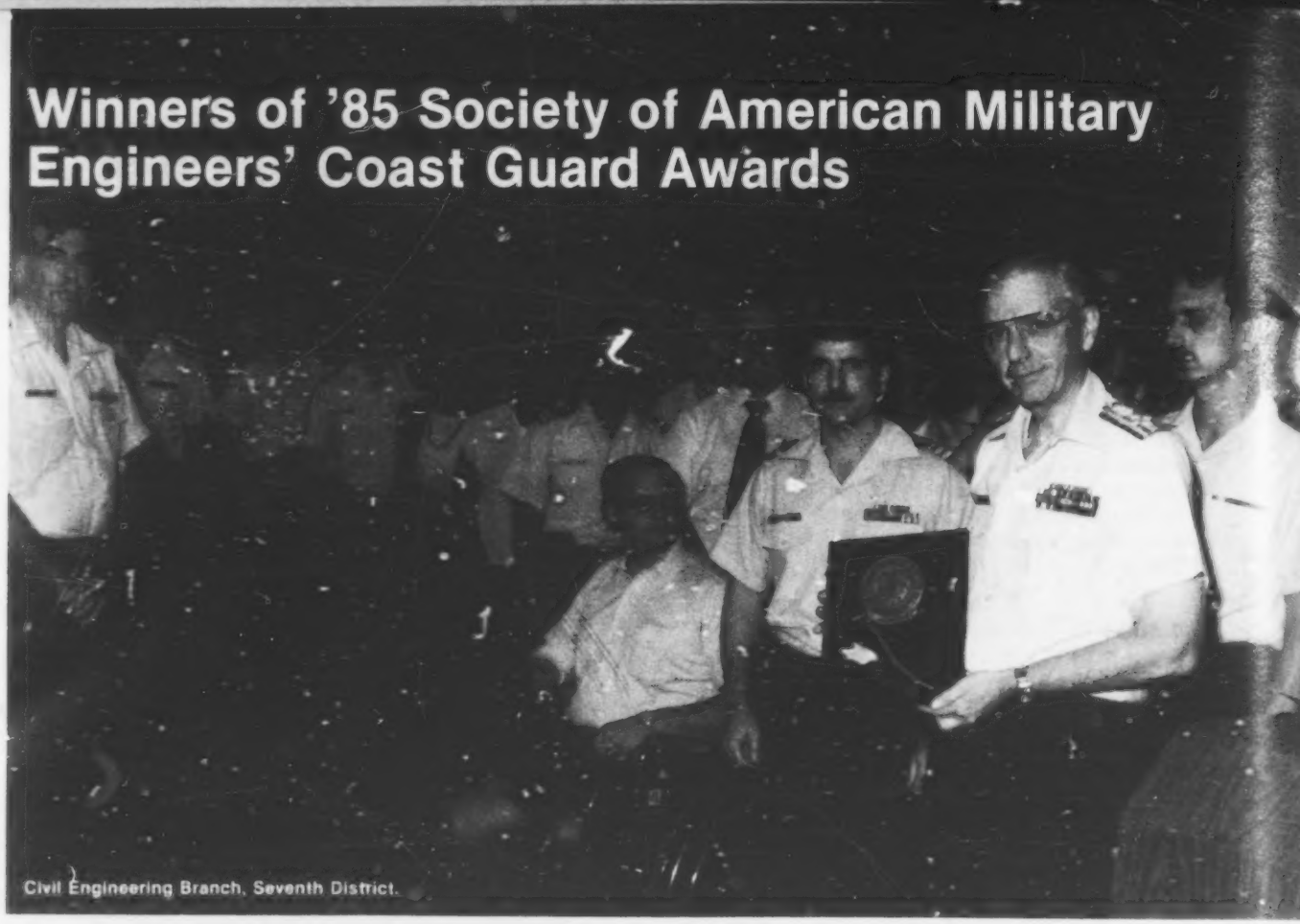
Fast Surface Delivery Sleds

The Coast Guard Fast Surface Delivery (FSD) Sled was improved by a Marine Environmental Protection Equipment Alteration (MEPALT) this spring. (The MEPALT involves placing weatherproof identification and operating instruction plates on the sleds.) The 1/16-inch aluminum plates, affixed to the sleds, provide sled crews with operational checklists and other useful information.

The Ship Inventory Control Point (SICP) at the Coast Guard Yard is now stocking spare parts for the FSD Sled. Contact LT Davis (G-EOE-2) at FTS 755-4874 if you need assistance with replacement parts.

Fast Surface Delivery (FSD) Sled.

Winners of '85 Society of American Military Engineers' Coast Guard Awards



Civil Engineering Branch, Seventh District.

1985 Cowart Plaque Awarded to Seventh District

The significant increase in the number of vessels, aircraft, and personnel assigned to the Seventh District has heavily affected shore requirements, resulting in a large number of high-priority, short-turnaround shore facility requirements. The Civil Engineering Branch's response was prompt, of outstanding quality, and contributed to the District's overall success. Some of the major accomplishments include:

- In addition to the normal maintenance projects, the District continued to design and execute a large acquisition, construction, and improvement work load. Much of this work load came as insertions in the current year budget due to the accelerated operational needs.
- Comprehensive civil engineering efforts to identify and correct District infrastructure problems resulted in four major waterfront projects—Base Miami Beach, Port Canaveral, Station St. Petersburg, and Station Fort Lauderdale—being designed, funded, and under construction. Additional ongoing master plans are expected to identify other major infrastructure renewal requirements that are crucial to long-term operational success.
- Fine tuning and institutionalizing of management improvements provided increased available professional design time, enabling the branch to increase its total maintenance obligations. This resulted in very high productivity, as measured by the annual resource exchange ratio.
- In addition to producing quality design and construction projects in compressed time frames with exceptional results, the branch maintained an excellent professional development program, providing a high number of hours of training as well as strongly supporting professional engineering registration.

This outstanding performance by the Seventh District Civil Engineering Branch in support of a rapid increase in Coast Guard operational initiatives is heartily commended.

Cowart Plaque

The Cowart Plaque is an award named after the former Chief of the Office of Engineering, U.S. Coast Guard, VADM Kenneth K. Cowart. The plaque is offered annually as an award of excellence to the Coast Guard civil engineering or facilities engineering organization which has made the most outstanding contribution to the Coast Guard civil engineering program. It was first awarded in 1968.

1985 Oren Medal Awarded to Mr. Bob D. Lamm

Mr. Bob D. Lamm serves as the Chief of the Design Division of the Coast Guard Facilities Design and Construction Center (FD&CC), East, in Norfolk, VA.

During 1985, the FD&CC was tasked with a very heavy design work load that was accomplished within budget and on time, despite late approvals of project proposal reports and changing project requirements, resulting from A-76 and statement of essential need overviews.

During the year, the Design Division completed 22 designs, having a total budgeted project value of $52.6 million and, at year end, an additional 20 designs underway with a budgeted project value of $47.5 million. Construction contracts on 20 of the designs completed in 1985 were awarded at less than project budget, resulting in almost $8 million in savings.

In addition to managing the FD&CC design work load, Mr. Lamm has established a number of new procedures for improving the design process. His management initiatives include a process for expediting design review, providing a project manager's checklist, revising procedures for end-user review, and expanding the use of computer-aided drafting for in-house design. Mr. Lamm's efforts this past year have resulted in a very heavy design work load accomplished on time and within budget, bringing great credit to himself, his command, and to Coast Guard engineering.

Oren Medal

The Oren Medal is named after RADM John B. Oren, past President of the Society and former Chief of the Office of Engineering, U.S. Coast Guard. The medal is offered annually as an award to a regular or reserve Coast Guard officer in active, inactive, or retired status; or to a Coast Guard civilian employee or retiree, of equivalent grade, in recognition of the most outstanding contribution to military engineering through achievement in design, construction, administration, research, or development. The award was offered for the first time in 1968.

Mr. Bob D. Lamm, FD&CC (East).

CWO2 Daniel Sathre, Air Station San Diego.

1985 Sargent Medal Awarded to CW02 Daniel Sathre

CW02 Daniel Sathre is the Maintenance Officer at Air Station San Diego, San Diego, CA.

He is responsible for the maintenance of the Air Station and Group San Diego facilities which encompass 26 buildings and over 132,000 square feet of shore plant. During this past year, primarily through his leadership, a number of noteworthy items have been accomplished: The completion of over $9,000 worth of OG-30 energy retrofit items which will produce savings of $3,400 per year; the removal of all underground, oil-filled electrical cables; the emergency replacement of high-voltage cable between the bachelor enlisted quarters (BEQ) and the public works building; the remodeling of the aviation survivalman (ASM) storage; and the installation of the waste-oil dikes at ballast point and the power cables at *Point Loma*.

CW02 Sathre has worked closely with the city of San Diego and the San Diego Regional Youth Employment Program. Through his efforts, employment and training were provided to area youth while obtaining additional maintenance for the air station. During the summer months, eight youths, hired through this program, were able to perform routine maintenance tasks, enabling his staff to address more complicated maintenance needs. This program enhanced the image of the Coast Guard in the local community and relieved his staff of the burden of many routine, seasonal maintenance tasks.

CW02 Sathre's commitment to excellence and leadership, combined with initiative, are a great reflection on the Coast Guard engineering community and are highly commended.

Sargent Medal

The Sargent Medal is named after VADM Thomas R. Sargent, III, former Chief of Civil Engineering and Vice Commandant of the Coast Guard (1970-74). The medal is offered annually as an award to an active duty Coast Guard warrant officer, chief petty officer, or petty officer; or to a Coast Guard civilian employee, of equivalent grade, in recognition of the most outstanding contribution to Coast Guard civil engineering or facilities engineering. The award was offered for the first time in 1980.

Hazardous Waste Management

The Hazardous Materials Technical Center (HMTC) has prepared the Hazardous Waste Management Profile for 18 Coast Guard units surveyed during 1984. This profile provides those units not surveyed, as well as District and Headquarters personnel, with information regarding types of potential hazardous waste generated from stations, bases, air stations, and support centers. The profile also provides an understanding of regulatory requirements associated with managing those wastes; a comparison of present management practices; and some recommendations to help ensure that wastes are handled in a cost-effective manner, complying with state and Federal regulations.

Major categories of hazardous waste being generated at Coast Guard units include batteries (AtoN, lead-acid, Nicad, lithium), spent thinners and paint slops, ship engine coolant (containing dichromate additive), and chlorinated and nonchlorinated solvents. Sand blast grit and bilge may require testing to determine whether it is a hazardous waste. Table 1 identifies potential hazardous waste streams (flow) at Coast Guard units. (*Note*: Proposed regulations issued by the EPA on November 29, 1985, established waste oil as hazardous.)

Most units were unaware of, or unresponsive to, their specific regulatory responsibilities for managing this hazardous waste. The following were weaknesses:

- Failure to notify state and/or Federal agencies of generation activities, particularly where state regulations are stricter than Federal regulations.
- Failure to identify, label, and segregate hazardous waste, particularly the spent thinners and the paint slops, the engine coolant, and the chlorinated solvents.
- Accumulation of hazardous waste under unsuitable conditions (e.g., unsecured area) and without necessary storage permit (i.e., longer than 90 days).
- Improper disposal practices (e.g., dumping on the ground, sanitary landfill disposal, and burning).
- Inadequate compliance with requirements for personnel training, preparedness and prevention, and contingency plan and emergency procedures.

Overall recommendations stress the need for:

- The education and training of Coast Guard personnel involved in hazardous waste management.

Representative Potential Hazardous Waste Streams at USCG Units

Waste	*EPA Waste No.*	*Hazardous Charac-teristic*	*Generating Units*[a]
Discharged AtoN batteries	D002	corrosivity	B/S; SC
	D009	EP toxicity (mercury)	
Engine coolant containing dichromate additive	D007	EP toxicity (chromium)	B/S; SC
Spent sand blast grit[b]	—	—	B/S; SC
Bilge and waste oil[b,c]	—	—	B/S; SC
Waste oil and fuel[c]	—	—	AS; SC
Lithium batteries	D003	reactivity	AS; SC
Nicad batteries	D002	corrosivity	AS; SC
	D006	EP toxicity (cadmium)	
Polyurethane foam kit			AS; SC
Part A: diphenylmethane di-isocyanate	D003	reactivity	
Part B: trichlorofluoromethane	U121	toxicity	
Spent fixer solution[d]	D011	EP toxicity (silver)	AS; SC
Wheel strip compounds[e]	—	—	AS; SC
Spent thinners/paint slops	D001	ignitability	B/S; AS; SC
	D007	EP toxicity (chromium)	
	D008	EP toxicity (lead)	
Lead acid batteries[c]	D002	corrosivity	B/S; AS; SC
	D008	EP toxicity (lead)	
Petroleum hydrocarbon solvents[c] (including PD-680 and Agitene)	D001	ignitability	B/S; AS; SC
Chlorinated solvents, including			B/S; AS; SC
Freon	F002	toxicity	
Trichloroethane	F001	toxicity	
	U226		
	U227		

[a] *Generating units: B/S = Base/Station; SC = Support Center; AS = Air Station.*
[b] *Analytical testing required to verify hazardous waste classification.*
[c] *Exempt from regulation when beneficially reused/recycled, unless mixed with a listed hazardous waste.*
[d] *Unless silver recovery is practiced.*
[e] *Hazardous waste classification dependent upon specific product in use and/or results of analytical testing for EP toxicity.*

Table 1.

HH-3F *Pelican* demonstrating its water landing rescue capabilities.

- The clear designation of hazardous waste management responsibilities at all levels of activities, specifically designating a hazardous waste coordinator and preparing a hazardous waste management plan.
- The contracting of licensed facilities for hazardous waste and waste oil transportation and disposal services.

Numerous specific recommendations are presented in the profile report. The final report was distributed to the districts and appropriate field units. Copies are also available through Commandant (G-ECV-2), FTS 426-1274.

Additional surveys were conducted during 1985 and early 1986 from a list of units recommended by the districts. Support centers and bases constitute the majority of these units. The 1986 survey is also examining a cross section of afloat units.

The recent surveys have indicated little improvements in handling hazardous waste, although there seems to be a greater awareness that a problem exists. One major obstacle has been the lack of communication between the shore, tenet, and afloat units. The 1986 survey should help address this problem.

Coast Guard Will Join Navy in Helicopter Acquisition

In an effort to keep costs to the Government down, the U.S. Coast Guard will combine its requirement to purchase 32 Medium Range Recovery helicopters with the acquisition the Navy is proposing for similar Combat Search and Rescue helicopters.

The new Medium Range Recovery (MRR) helicopters will replace the Coast Guard's HH3-F Sikorsky *Pelican* helicopters, which are nearing the end of their 20-year service life. The MRR helicopters have the capability of performing search and rescue operations from 150 to 300 miles offshore.

The Naval Air Systems Command is requesting competitive bids for variations of current model helicopters. Initial funding for the Coast Guard acquisition would come from the Coastal Defense Augmentation Fund, which Congress established in the Navy's 1986 appropriation. The Coast Guard helicopters will be essentially the same as the Navy's, with minor modifications in the electronics package.

5000th Aid to Navigation Converted to Solar Power!

Aids to navigation (AtoN) units have now converted 5,000 aids to solar power and have reached the halfway point of the original goal of 10,000 conversions. The success of this program is due to the enthusiasm of field units who have achieved the 5,000 conversion-mark a year early and should have 10,000 aids converted 2 years ahead of schedule! Conversion of the aids from expensive primary batteries that contain mercury and are considered hazardous waste will save several million dollars. In addition, field units will have more flexibility while conducting AtoN operations since they are no longer constrained by a strict recharge schedule.

However, the engineers have not been sitting idly while the operators have been installing the solar power systems. The Ocean Engineering Division has recently approved solar power designs for 5x11, 3½x8, and discrepancy buoys which were originally thought to have insufficient reserve stability for solar power. All three designs include a lightweight-aluminum, solar-panel mounting bracket and have the batteries secured as low as possible in the buoy pocket to maintain acceptable stability. The solar design for the 5x11 and 3½x8 buoys will allow an additional 1,000 aids to navigation to be converted and now allows all lighted buoys to be solar-powered.

The Ocean Engineering Division is also investigating high-efficiency lamps that may be used to reduce the power requirements of lighthouses. These lamps look very promising and should allow us to "solarize" more lighthouses. The potential cost savings at these larger aids to navigation can be substantial. The Twelfth District recently converted five lights, which would have required submarine cable replacement, to solar power at an estimated savings of $160K.

The districts have also been impressed with the reliability of the solar power systems. The Fourteenth District recently reported that their discrepancy rate has been reduced from 60 percent for primary-battery-powered aids to 5 percent for solar-powered aids. The Ninth District reports that the mean time between failures of three lighthouses formerly powered by diesel generators is 2-3 times longer now that they are solar-powered.

Island-Class Update

Seven of the 16 new Island-Class, 110-foot patrol boats have been delivered to the Coast Guard by Bollinger Machine Shop and Shipyard, Inc. of Lockport, LA. The procurement is proceeding smoothly, with deliveries now occurring on or before the scheduled 45-day intervals.

The first four cutters, homeported in Miami, are now part of the operational fleet. On May 13, the cutter *Manitou* (WPB 1302) celebrated the class' first drug interdiction with the seizure of the 125-foot M/V *Sunbird,* carrying 22 tons of marijuana.

Cutters five through eight are bound for Roosevelt Roads, PR, with the remaining eight slated for Portsmouth, VA, Seward, AK, Ketchikan, AK, Rockland, MA, Crescent City, CA, Eureka, CA, Atlantic City, NJ, and San Juan, PR.

USCGC *Monhegan* (WPB 1305) Roosevelt Roads (PR) bound.

Member Agencies:

United States Coast Guard
Naval Sea Systems Command
Maritime Administration
American Bureau of Shipping
Military Sealift Command
Minerals Management Service

Ship Structure Committee

An Interagency Advisory Committee
Dedicated to the Improvement of Marine Structures

Address Correspondence to

Secretary, Ship Structure Committee
U.S. Coast Guard Headquarters (G-M/TP 13)
Washington, D.C. 20593
(202) 426-2197

Ship Structure Committee Publishes New Reports

The Ship Structure Committee has recently published 10 new technical reports of interest to those concerned with the design and safety of ships and offshore structures. The reports are as follows:

SSC-317 **Determination of Strain Rates in Ship Hull Structures: A Feasibility Study**
This report presents a survey of existing data on shipboard stress/strain rates. The data bases are evaluated, and strain rates from existing ship data are developed.

SSC-319 **Development of a Plan to Obtain In-Service Still Water Bending Moment Information for Statistical Characterization**
This report reviews previous instrumentation programs and recommends means to gather still water bending moment (SWBM) data in sufficient quantity to be useful for statistical characterization and to obtain SWBM envelope curves.

SSC-321 **Survey of Experience Using Reinforced Concrete in Floating Marine Structures**
This report reviews applications of marine concrete structures, research into concrete structures, and inspection and repair of these structures and presents an extended bibliography on the subject.

SSC-322 **Analysis and Assessment of Major Uncertainties Associated with Ship Hull Ultimate Failure**
This report considers the uncertainties of the primary hull longitudinal compression failure mode and uses coefficients of variation to obtain safety indices used in this reliability design approach.

SSC-323 **Updating Fillet-Weld Strength Parameters for Commercial Shipbuilding**
This report presents a possible alternative method of assessing fillet weld requirements to the ABS weld tables. The recommended methodology is demonstrated on previous designs, pointing to a cost saving of (from 9 to 15 percent) welding costs.

SSC-324 **Analytical Techniques for Predicting Grounded Ship Response**
This report investigates the use of portable computers during salvage scenarios after a ship grounding and demonstrates how they could be used by the salvage master.

SSC-325 **Correlation of Theoretical and Measured Hydrodynamic Pressures for the SL-7 Containership and the Great Lakes Bulk Carrier S. J. Cort**
This report shows the amount of correlation between theoretical calculations, model testing results, and full-scale data collection of hydrodynamic pressures on the SL-7 class of containership and the M/V Stewart J. Cort.

SSC-326 **Long-Term Corrosion Fatigue of Welded Marine Steels**
This report represents a first look at corrosion fatigue by the Ship Structure Committee. It assesses those future directions that would be most fruitful for further study, approaching fatigue from both the deterministic and the probabilistic viewpoints.

SSC-327 **Investigation of Steels for Improved Weldability in Ship Construction**
This report is directed toward determining the weld procedure and metallurgical control necessary to develop adequate toughness in the

weldment, using high-deposition rate weld procedures. This report is the third and final phase of the welding effort and follows SSC-298 and SSC-305.

SSC-328 **Fracture Control for Fixed Offshore Structures**
This report gives a state-of-the-art summary of material selection design, construction and operation of fixed offshore platforms and explains how detrimental fractures are prevented. This report will serve as a basis for beginning a fracture control program.

A limited number of reports will be available free of charge. After that, copies will be available from the *National Technical Information Service (NTIS), Springfield, VA 22161*. For copies of the reports or further information, contact LCDR Thomas H. Gilmour, Secretary, Ship Structure Committee, U.S. Coast Guard (G-MTH-5), 2100 Second Street SW., Washington, DC 20593.

WPB Capability Replacement Acquisition Project

Coast Guard Headquarters' new Office of Acquisition is now proceeding down four tracks to complete the major project of providing replacements for the 82- and 95-foot patrol boat classes.

The DoD has received an appropriation to procure 16 more 110-foot cutters. The Navy will compete and administer this contract, working with Coast Guard technical support under a memorandum of understanding (MOU).

The remaining tracks include response, fully capable, and advanced marine vehicle designs.

The response cutter will be a 60-90 foot search and rescue (SAR) resource destined primarily for cases up to 50 nm offshore and in areas such as the Pugent Sound and Chesapeake Bay.

The fully capable cutter will be no longer than 120 feet, monohull in design, prosecuting cases up to 200 nm offshore. It will have at least a 5-day provision endurance and an economical speed range of 1,100 nm.

The advanced marine vehicle will also be less than 120 feet in length and have a 5-day provision endurance. This cutter will have an economical speed range of 1,300 nm and will be destined for heavy weather operations, being able to carry out all primary missions in up to sea state five.

Present scheduling anticipates prototype construction commencing for all tracks by 1991.

New Wave-Activated Generators for Exposed Location Buoys

The Coast Guard has recently obtained two units of a newly developed wave-activated generator for testing as buoy power sources.

These generators, manufactured under the trade name of *Whale* by Muenster-Simms Engineering, Ltd. of Northern Ireland, are being tested as an alternative to the generators, manufactured by the Ryokuseisha Corporation of Japan, which are currently in use on 9X35 Lighted Radar Buoys.

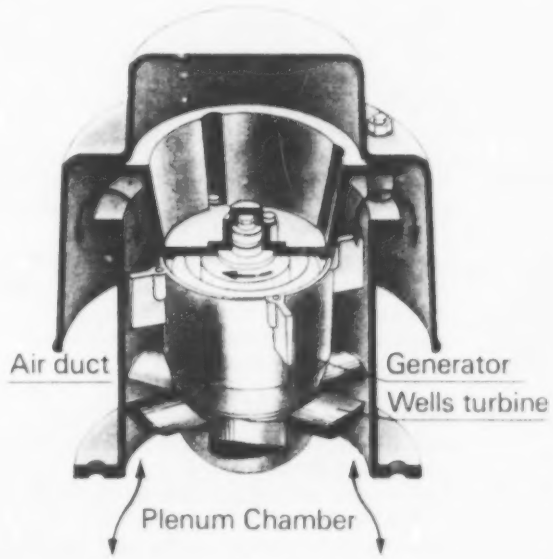
The two generators compensate for changing airflow direction (as the buoy moves up and down) in different ways.

The Ryokuseisha generators use a series of flapper valves to regulate airflow over a set of unidirectional turbine blades.

The *Whale* generators, however, utilize symmetrical airfoil turbine blades which are effective regardless of the direction of airflow.

The first *Whale* generator was deployed on the Delaware Bay Junction (DBJ) Exposed Location Buoy in early May as part of a 1-year test.

Equipped with a wave-activated generator and a full suite of signals (main and passing lights, racon, and electronic horn), the 9X35 buoy approaches the capability of a Large Navigational Buoy at one-tenth the cost.



100-W Wells Turbine Generator Module.

***Bittersweet's* deck force prepares to set a superbuoy.**

Development Progress with Electronic Programmable Controllers for Major Aids to Navigation

The following is a brief progress report on the acquisition and support of electronic programmable controllers for the automatic control of various subsystems on automated lighthouses and Large Navigational Buoys (LNBs).

During the design and development phase of a past project to replace LNB flashtubes with incandescent lamps and conventional optics, it was demonstrated that programmable controller technology (microprocessors) and related hardware had matured to a point where they should be considered for many AtoN applications. Therefore, prototype Light Signal Controllers (LSCs) were developed, tested, and deployed for reliability determinations on LNBs—operating incandescent lamps in conventional optics.

The first installation was on a LNB hull on the Five Fathom buoy station. This installation has been reliable since its inception in 1982. The second installation was on a hull on the Nantucket station and that too has been reliable. Mean time between failures (MTBFs) are on the order of several years for these relatively low-cost devices, even when deployed on a LNB platform. MTBFs can be expected to be even better in fixed-aid applications. As a side benefit, the LSC eliminated the need for a separate, external, light-signal navaid sensor module.

Subsequently, a general purpose controller (GPC) concept evolved using this technology. Simply stated, the concept means that one can take the primary programmable components and peripheral hardware, mount them in a cabinet, and then program the components to handle literally any future AtoN subsystem control requirement. Due to various industry standards, a satisfactory degree of standardization can be achieved with improved maintainability. To test this general purpose concept, a prototype LNB buoy power controller (BPC) was designed and tested (using LSC components) to replace the existing, aging, and obsolete controllers on LNBs. These existing LNB controllers (non-LAMP) are 1960's technology and now 12–16 years old; hence, many PC card parts are not available.

The results of this development project were so encouraging that 15 production controllers were built under a minority contract to replace all aging LNB controllers. A LNBALT will be issued in fiscal year 1986 for the installation of production controllers.

In view of the previously described experiences, electronic programmable controllers are expected to be an integral part of major AtoN hardware for control packages built in 1986 and beyond in the foreseeable future. Their physical simplicity at the "board" level lends itself to building and testing via minority contracts, as well as providing improved maintainability.

Facility Standards and Policy

In the last few months, several facility standards and policy manuals have been completed or revised by the Headquarters' Civil Engineering Division. These projects are a joint effort of civil engineering and appropriate program managers.

On April 17, 1986, Change 4 to the Multimission Station Design Guide was issued as COMDTNOTE 11012. No more changes are expected to this manual in the near future.

The Space Component Standards (COMDTINST M11012.7) was signed on May 13, 1986. This edition of the manual will have 3 of the proposed 10 components—administrative, bachelor housing, and dining. The remaining components will be issued as they are developed.

The Civil Engineering Manual Revision, Phase I (8 of 19 chapters), was distributed in early June. Phase II, consisting of at least six or more chapters, is scheduled for fall completion.

Chemical Response Suit Update

The Teflon chemical response suit (CRS), procured by Headquarters' Ocean Engineering Division (G-EOE), was recently shown by the National Strike Force (NSF) at the St. Louis Hazardous Material Conference. The interest in the CRS was beyond our expectations; two additional printing runs of the suit's literature had to be made because of demand. Since the conference, the Army and the Air Force have begun investigating the Teflon suit material for use by their services. Preliminary test results indicate that the suit provides at least 60 minutes of protection against all chemicals shipped in commercial quantities, except carbon disulfide. (All self-contained breathing apparatus (SCBA) used by the NSF are rated at 60 or less minutes.) Suit documentation (chemical breakthrough times and flow rates after breakthrough) is proceeding parallel to the construction of these new suits.

Aid Control and Monitor System Technical Manuals

925.—Final technical manuals for the Aid Control and Monitor System (ACMS) have been received at Supply Center (SUPCEN) Brooklyn. Arrangements have been made with SUPCEN to stock these technical manuals in the regular technical publications locker.

There are three separate manuals, as follows: First, master unit; second, remote unit; and third, transfer unit.

The actual stocking point is in the APA stock under commodity "P". Field units should order manuals directly from this source.

Stock number and JEDS nomenclature is as follows:

Master.—(Control-Display) Group, CG 7610-01-GF4-1105; *Remote.*—(Monitor) Group, CG 7610-01-GF4-1100; *Transfer.*—(Interconnecting) Group, CG 7610-01-GF4-1101.

Joint Electronics Type Designation System (JEDS) Nomenclature

Master (Control-Display) Group OD-193(V)1; Remote (Monitor) Group OA-9211(V); Transfer (Interconnecting) Group ON-267(V); Total ACMS System USQ-91(V).

Teflon will be the uniform of the day for chemical spills.

Luminous vs. Nominal Ranges for Major Coast Guard Lights

By LT Wayne A. Fisher
USCGC *Tampa* (WMEC 902)
Portsmouth, Virginia

Introduction

Aids to Navigation (AtoN) personnel sometimes misunderstand and misuse the terms "luminous range" and "nominal range." This article discusses the importance of these two terms. Examples are given comparing luminous and nominal ranges. A method is suggested which can be used to evaluate the spacing of major aids in a District. Plain language is used in the article. For a detailed technical explanation of luminous and nominal ranges, refer to COMDTINST M16510.2 (Luminous Intensities of Aids to Navigation Lights).

Luminous Range

The luminous range is the maximum distance you can detect a light for a given condition of visibility. The luminous range is calculated from an equation called Allard's Law:

$$E = \frac{I \quad T^D}{D^2}$$

I is the effective luminous intensity of the light.
T is the atmospheric transmissivity (another way to express visibility).
E is the threshold of illuminance, that is, the minimum amount of light that can be detected by the eye for a given background level of lighting.
D is the luminous range.

To calculate a luminous range, you must know what numbers to use for *E*, *I*, and *T*.

For *E*, use 0.67 sea-mile candela for no background lighting; 6.7 sea-mile candela for minor background lighting; and 67.0 sea-mile candela for heavy background lighting. Do not be concerned with the unit sea-mile candela. Accept the fact that it is what you need to calculate luminous range in units of nautical miles.

For *I*, look up the appropriate value for the proper lens/lamp combination in COMDTINST M16510.2. Keep in mind that the values tabulated are for new equipment, properly focussed, and operating at design voltage. Also, be sure to apply any correction factors to the tabulated value. For example, if a DCB24 is placed in a lighthouse, the tabulated value for *I* must be multiplied by 0.88 to account for the loss of light when light passes through a window pane.

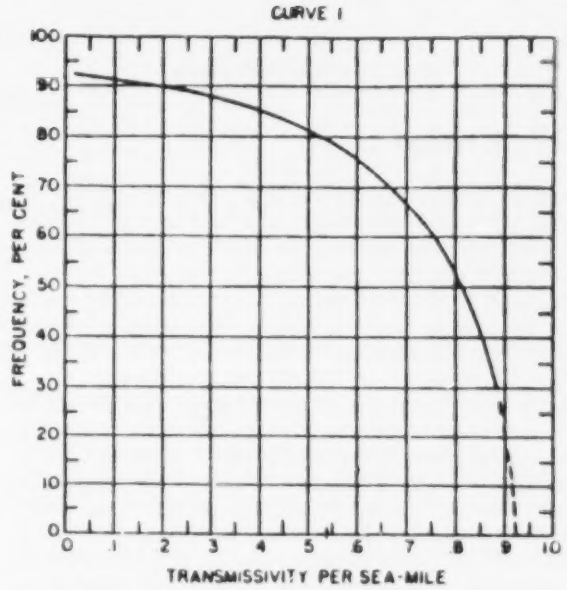


Figure 1.

For *T*, refer to the transmissivity curves in CG-250-37 (Visual Signalling). COMDTINST M16500.7 (Aids to Navigation Manual: Administrative) provides guidance on which value of *T* to use. (Generally, major aids are designed on a transmissivity that is met or exceeded 90 percent of the nights in a year. Minor aids are designed on a transmissivity that is met or exceeded 80 percent of the nights in a year.) Knowing the correct value of *T* to use in Allard's Law is important because the *T* value is the primary factor which determines the approximate range a mariner will detect a light.

As an example of how to calculate a luminous range, consider a DCB24 rotating beacon with a 1000-watt, tungsten-halogen lamp. The speed of rotation is 5 rpm. From table 6-1 (COMDTINST M16510.2), the uncorrected luminous intensity of the beacon is 510.000 candelas. The beacon is to be used in a lighthouse along the coast of Maine. The correction for the panes of the lighthouse is 0.88, making *I* equal to 448,000 candelas. Assume no background lighting so *E* equals 0.67 sea-mile candela. Figure 1 (from page 102 of CG-250-37) gives transmissivity values for the coast of Maine.

The lighthouse is a major light so for frequency equal 90 percent, T equals 0.2. Knowing I, E, and T solve Allard's Law for the luminous range:

$$E = \frac{I \ T^D}{D^2}$$

$$0.67 = \frac{448{,}000\ (0.20)^D}{D^2}$$

$$D = 6.1 \text{ nautical miles}$$

Nominal Range

Nominal range is simply Allard's Law solved for T equals 0.74; i.e., a visibility of 10.0 nautical miles. For the DCB24 in Maine, the nominal range is 24 nautical miles. Nominal range is important because it is what we advertise in the Light List, what we use on nautical charts, and what we use to compare capabilities of hardware. However, in selecting hardware to satisfy an operational requirement, the AtoN engineer must design for a particular transmissivity. For the previous example, if we were tasked with providing a 15.0-nautical-mile, luminous range light for the coast of Maine, the DCB24 with 1000-W lamp would not meet the operational requirements. The optic would be a 15.0-mile light in Florida or Hawaii. The important point is that AtoN personnel, who select hardware to meet operational requirements, must understand the differences between luminous and nominal ranges. Blindly using the information in COMDTINST M16510.2 or the selection guides in the AtoN Manual-Technical could result in optics not meeting operational requirements.

Additional examples of the differences between luminous and nominal ranges for various transmissivities are shown in figure 2. Calculations are for a DC190-mm rotating beacon with a 12V, 3.05-amp lamp, turning at 1 rpm. I equals 17,922 candelas. E equals 0.67 sea-mile candelas. Values of T are for a 90 percent of the night criterion. T values are rough approximations based on the transmissivity curves in CG-250-37. (Note that the luminous range is less than the nominal range in all but two districts.)

The way to interpret figure 2 is as follows: In the First District, a 190-mm beacon will provide at least a 4.5-nautical-mile light 90 percent of the nights in a year. Or—expressed in a more positive way—the 190-mm beacon described will provide a 4.5-mile light, or greater, 90 percent of the nights in a year. The practical interpretation of the data is this: If a mariner is to see at least one major light 90 percent of the time while transiting the New England coast, and if the DC190-mm beacon with a 3.05-amp lamp is the light source, then lighthouses should be spaced every 9 miles along the coast. This statement assumes that the DC190 mm would be used in all the lighthouses. Of course, this would not be the case. However, luminous ranges can be calculated for any optic in any District. The next section compares luminous and nominal ranges of actual Coast Guard lighthouses.

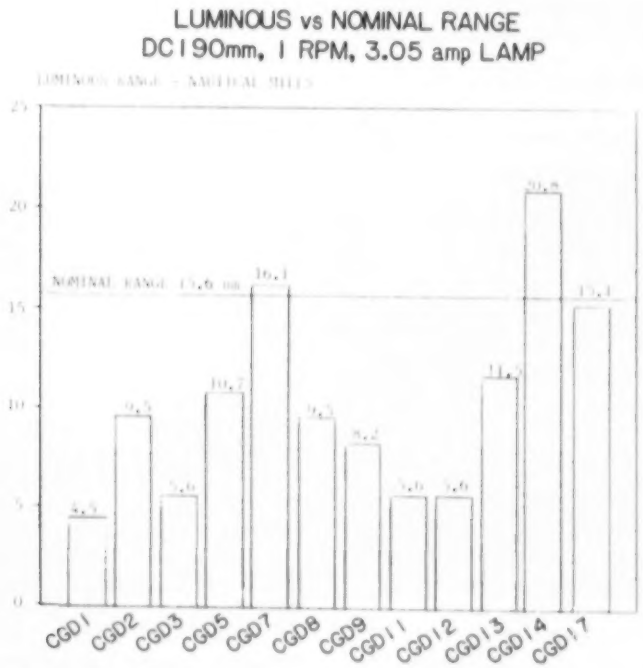


Figure 2.

LUMINOUS VS NOMINAL RANGES FOR VARIOUS COAST GUARD LIGHTHOUSES

LIGHTHOUSE	DISTRICT	LIGHT LIST	VOLUME	OPTIC	EFFECTIVE INTENSITY candelas	T	CURVE	LUMINOUS RANGE nm	NOMINAL RANGE nm
Martinicus Rock	1	2/239	I	DCB224	607,200	.20	1	6	24
Execution Rocks	3	984	I	DCB10	24,800	.30	5	6	16
Chesapeake	5	151	I	DCB224	580,000	.53	9	13	24
Sand Key	7	102	II	DC190mm	15,771	.78	12	17	15
Cape SanBlas	8	173	II	DCB24	690,000	.56	14	15	25
White Shoal	9	17090	IV	DC190mm	15,771	.35	30	6	15
Point Arguello	11	30	III	DCB24	580,000	.30	15	8	24
Alcatraz	12	578	III	DCB10	15,500	.30	17	6	15
Cape Flattery	13	115/2225	III	DCB24	607,000	.62	18	17	24
Barbers Point	14	3833	III	DCB224	510,400	.82	23	33	25
Five Finger	17	3153	III	DCB24	396,000	.72	24	22	24

Table 1.

Luminous vs. Nominal Ranges of Various Lighthouses

Table 1 lists a major light for each Coast Guard District except the second. Information on the optic and effective intensity was obtained from either personal knowledge or from form CG3213A (AtoN Operation Request, Supplement). The transmissivity values are for the 90 percent criterion. Curve numbers refer to the curves in CG-250-37.

Using the information in table 1, luminous and nominal ranges are compared graphically in figure 3. For the lighthouses in this example, the luminous range is less than the nominal range in all districts except the seventh and the fourteenth. Where the transmissivity is poor, there is a noticeable gap between luminous and nominal ranges. This gap becomes less significant if an 80 percent design criterion is used. Figure 4 displays the luminous and nominal ranges of the lighthouses for the 80 percent design criterion.

Luminous vs. Nominal Ranges' Diagram

Figure 5 is a diagram which enables a mariner to determine the approximate range at which a light may be sighted at night for a given visibility. The diagram is reproduced from the Light List (CG-158). While the diagram is an extremely useful tool for the mariner, it cannot be used by AtoN engineers to check the spacing of major lights. Nonetheless, the diagram does show the dramatic effect visibility (i.e., transmissivity) has on the luminous range of a light. This effect must be appreciated and considered when designing an aids to navigation system.

Conclusion

The Coast Guard recently implemented the Waterways Analysis and Management System (WAMS). It will be used to evaluate, plan, and manage the Coast Guard's Short-Range Aids to Navigation Program. An important part of WAMS is for District planners to assess the strengths and weaknesses of an existing aid system every 3 years. The information presented in this article can help District planners evaluate major lights in an aid system. A suggested way to do this follows on page 16.

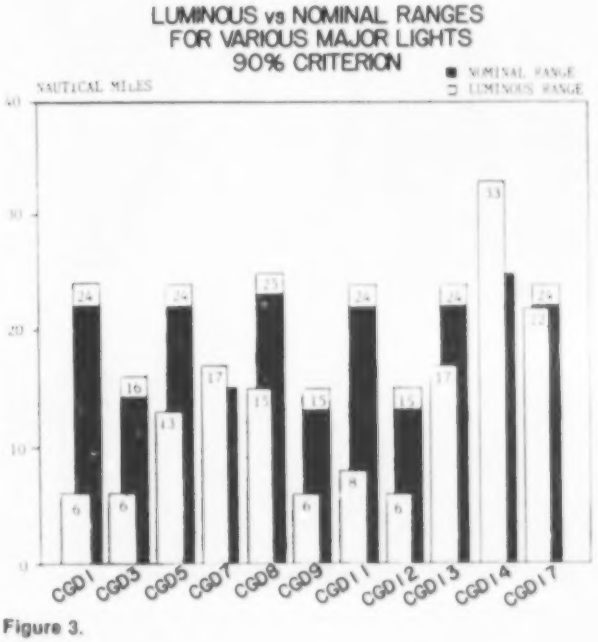


Figure 3.

For a major light in a District, first decide which transmissivity curve should be used. Select the *T* value corresponding to the 90 percent of the night criterion. Then, knowing the effective intensity of the light and the background lighting, use Allard's Law to calculate the luminous range of the light. Next, obtain a small-scale chart of the District. Draw on the chart an arc equal to the luminous range of the light. Repeat this process for each major light in the District. When finished, verify that a mariner transiting an established coastal route will always see at least one major light. Also check that adequate coverage is provided to allow a mariner to make the transition from an open ocean trip into the short-range aid system. If either of these two conditions are not met, there are three things which could be done:

First, it may be possible to increase the intensity of a light to provide additional coverage. If this approach is taken, keep in mind that the nominal range we advertise will also increase. Second, new major lights could be constructed. This solution, of course, is expensive. Also, the purpose of the 90 percent criterion is not to encourage new major lights, but rather to discourage the downgrading of lights which are important to mariners. The 90 percent criterion for major lights is a goal we strive for: it is not an end in itself. Finally, the situation could be left as is. This solution is not entirely unacceptable since local conditions may exist where meeting a 90 percent criterion is not possible or even necessary. This alternative gives the District commanders the maximum flexibility to decide what will work best in their districts.

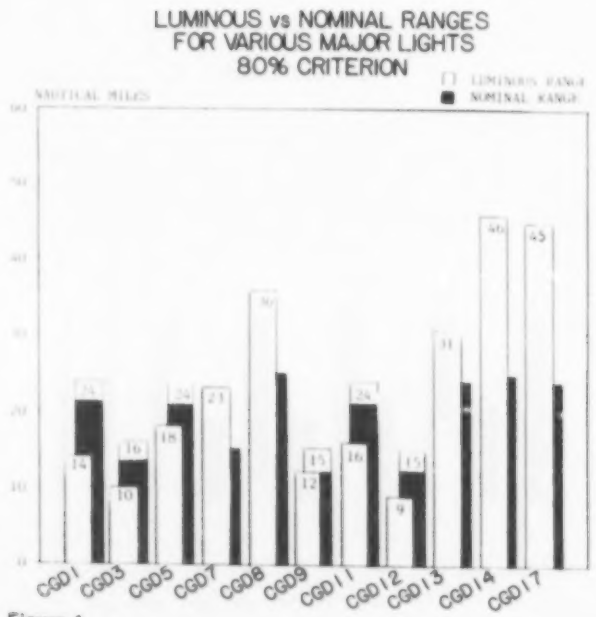


Figure 4.

LUMINOUS RANGE DIAGRAM

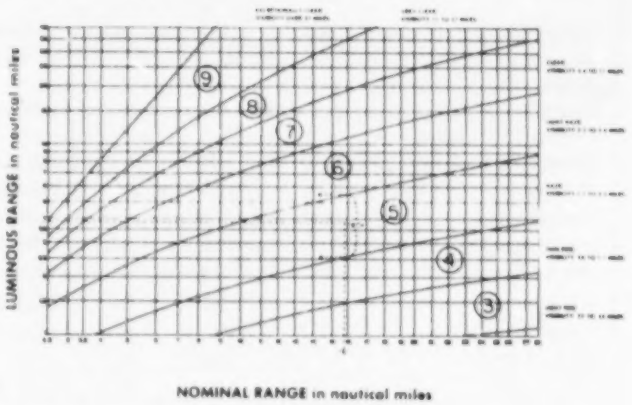


Figure 5.

Whichever approach is adopted, the basic point of this article remains unchanged: AtoN personnel must understand the difference between luminous and nominal ranges. AtoN planners must state operational requirements in terms of luminous range. Failure to do so may result in AtoN engineers selecting an optic which may not meet an operational requirement. For their part, AtoN engineers must select the proper equipment to meet the operational requirements based on the luminous range. To avoid confusion, requirements should not be stated as "We need an 18-mile light," but as "We need a light with an 18-mile luminous range." Only by communicating with the same language, can AtoN personnel work together to provide the best aids to navigation light for the mariner.

About the Author

LT Fisher is currently assigned to the USCGC Tampa *at Portsmouth, VA. His previous tours included signal branch of the Civil Engineering Division at U.S. Coast Guard Headquarters, admissions at the Coast Guard Academy, and deck watch officer aboard the USCGC* Midgett. *LT Fisher graduated from the Coast Guard Academy in 1977, and earned a master's degree in physics from the Naval Postgraduate School, Monterey, CA, in 1982.*

Chief Engineer's Comments

This article emphasizes the need for the District engineer to design navigational lights according to the visibility conditions in a local area. It is also important for everyone involved with lighted aids to navigation (AtoN) to know the limitations in using the nominal range designation of a light.

Coast Guard Safety Program Turns Asbestos Removal From Deadly to Doable

Reprinted, with permission, from *Insulation Outlook*, January 1986.

Introduction

After 41 years of polar duty and high seas daring do, the USCGC *Westwind* may have earned the U.S. Coast Guard's pride—but is today an asbestos-filled problem.

The 269-foot icebreaker is now becalmed at the Coast Guard's 112-acre Curtis Bay repair yard on a Patapsco River estuary just south of Baltimore. In addition to a thorough overhaul, the 7,150-ton cutter is undergoing a safety-conscious insulation replacement before returning to her heavy duty work in frozen polar waters next October.

"You can't be too careful when removing asbestos," says industrial hygenist Chris Walls of the Coast Guard's Curtis Bay Safety and Occupational Health Office. The Coast Guard has established a strict asbestos removal program that monitors the environment and regulates ventilation, work practices, and personal protection. The object is to get the job done—but not at risk to workers' health.

"Every (insulation) worker needs to know how asbestos can be removed safely," says the crew leader for the Coast Guard's four-man removal squad. This is easier said than done when the deadly subject has been too often shrouded behind a veil of self-conscious silence and fear. But the Coast Guard's safety program for its own work provides a model of what can and should be accomplished in a burgeoning asbestos removal industry too often characterized by "rip and run" removers.

Asbestos removal will continue to be a $2 billion-a-year industry for the next two or three decades, according to insurance company estimates. But despite its size, regulations to ensure worker safety is virtually nonexistent. Only a few states, including Maryland and Virginia, require training and certification for asbestos removal contractors.

The Coast Guard has not applied any asbestos since the material's danger was widely affirmed in the early seventies, says Curtis Bay's safety director, Joe Botts. However, Curtis Bay workers have been replacing asbestos insulation in Coast Guard vessels long before that. "Just about every ship that comes here gets part or all of its asbestos removed," Walls says, with the most complete removal targeted for crew living and working areas.

Mindful of the harm asbestos fibers threaten, the Coast Guard began instituting its safety program piecemeal about a decade ago. Strongly enforced since 1980, today's stringent program can serve as a model for all insulation contractors removing asbestos now or thinking of tapping this growing market.

Although each Coast Guard removal job may be tiny by industrial or commercial standards, its safety program features are easily duplicated elsewhere. The program precautions not only maintain workers' health but also avoid adding to the 24,000 asbestos-related personal injury suits industry officials estimate are already on the books.

Only trained pipe insulators are allowed to remove the asbestos-containing material.

The USCGC *Westwind* in normal habitat, the Bering Sea.

The Coast Guard program both sharply limits exposure and regulates working environments. It says unprotected personnel shall not be exposed to airborne asbestos fiber concentrates exceeding 0.1 fibers longer than 5 micrometers per cubic centimeter of air (0.1 f/cc) averaged over an 8-hour day and 0.1 f/cc in living environments. Using or installing new asbestos-containing materials is completely prohibited except for brake and clutch linings and certain gasket materials where acceptable substitutes do not exist.

Given the amounts of asbestos used throughout the years and its huge removal and replacement cost, the Coast Guard repairs rather than removes asbestos insulation unless it is damaged or ineffective, says safety director Joe Botts. But since any removal job will exceed the established asbestos exposure limits, the Coast Guard strictly regulates how the job is to be done in a four-part process.

Personnel Protection

That task starts with the workers themselves. Only trained personnel, rather than ship crew members, can remove asbestos insulation or other materials. A crack four-man crew of pipe insulators has been trained and is annually retrained and recertified by the privately funded Maryland Committee on Occupational Safety and Health. The crew members are wary about the job but admit "we work pretty well together after all this time." Botts calls them "conscientious and well-trained."

Training is only part of the personnel protection required for each remover. What they wear and how they breathe is also critical for work site safety. If environmental air sampling indicates working conditions will exceed allowable exposure limits, workers must also don disposable, impermeable coveralls complete with hoods, gloves, and foot coverings. They also wear side-shielded safety glasses or goggles whenever full-face respirators are not used. Although battery-powered or continuous air flow-supplied respirators are not required when removing intact thermal insulation panels, they are mandatory during other on-board repairs and removal operations.

Coast Guard procedures require a clothes changing area close but physically separate from

the asbestos work site. Two separate clothes lockers are provided, one for work and the second for street clothes. Nearby showers are available for exposed workers to shower after leaving the removal site once their workday is done.

Work Practices

The removal crew members are not all that is protected from asbestos. The immediate work site must be shielded as much as the coverall-clad removal crew so renovation work can continue safely elsewhere on the ship. The second part of the Coast Guard's safety program for its ships is to segregate work areas from general use with ropes, plastic drop cloths, and dust partitions. Each seam is safely taped, and every work area deck, bulkhead, and overhead must be totally shrouded. Signs caution "danger only protected personnel permitted within this area." The crew handles, cuts, and removes as much of the asbestos as possible in a sufficiently wetted-down state to keep airborne fibers below exposure limits. Areas contaminated with asbestos insulation scrap and debris must be vacuum-cleaned or wet down before sweeping to help control asbestos dust. Vacuum cleaners must be of a special high efficiency and filtered type.

The asbestos removal program regulates ventilation, work practices, and personal protection.

Ventilation Protection

The third part of the safety program focuses on reducing to the approved minimum any errant asbestos fibers the removal work sends floating into the air. This can be achieved by strictly controlling the work site ventilation as well as the type of removal work practices and cleanup permitted.

All general work area ventilation systems, for example, are stopped before removal operations commence and not restarted until cleanup has been finished. Temporary ventilation to cut airborne asbestos concentrations can be provided through approved ventilation air filters, if needed. Any power-operated tools must have a local exhaust ventilation system through approved air filters, if used. But the crew working on the *Westwind* "is careful not to disturb the fibers," Walls says. "They do most of their cutting and scraping by hand."

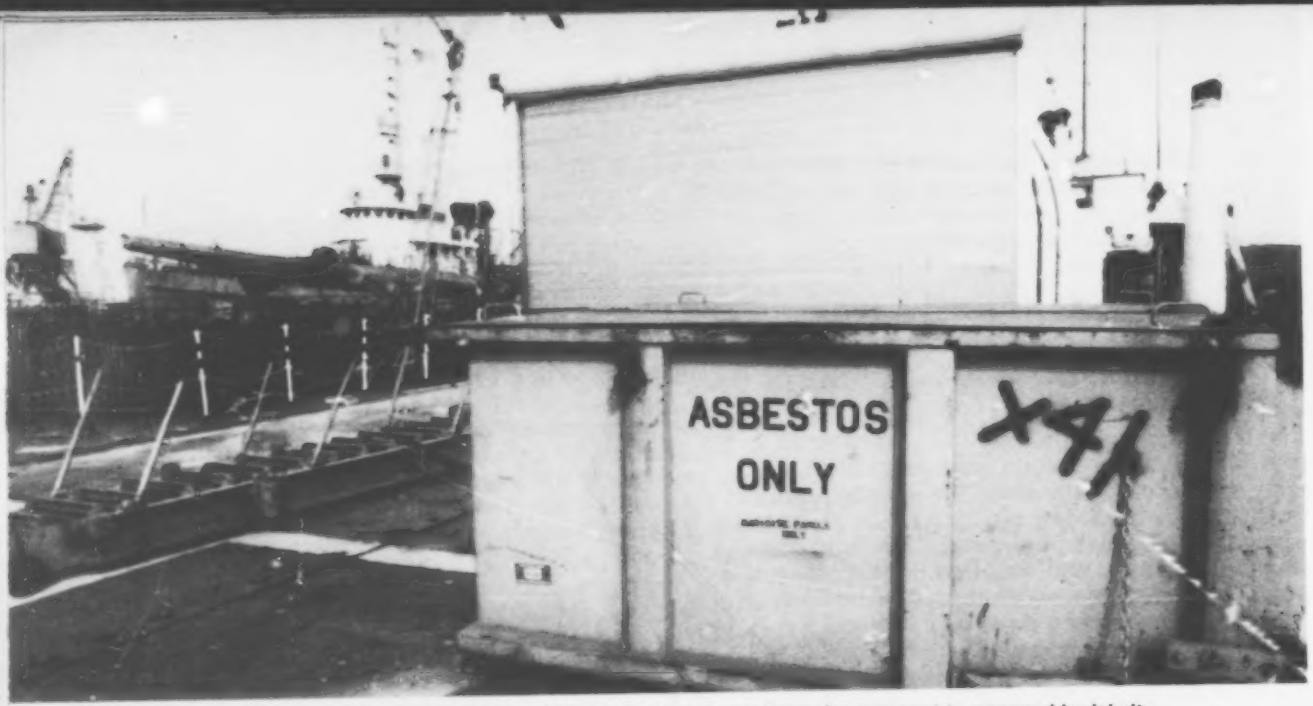
Disposal

Once removed, waste, scrap, debris, equipment, and asbestos-contaminated clothing consigned for disposal must be collected, wet, and discarded in a sealed, impermeable plastic bag. The Coast Guard's safety program requires each suitably labeled bag to be buried under at least 2 feet of earth at public landfills operated according to state and local regulations.

All these precautions are carefully followed even though the amount of insulation removed and replaced is relatively small. *Westwind*'s insulation contract, excluding piping, totals only $15,000 for replacing bulkhead, shell, and hull insulation. But the work can be tedious and will require some 5,200 hours of labor worth $156,000 all told. Basically, two types of asbestos insulation are being removed. Half-inch chrysolite asbestos, a compressed panel resembling dry wall, divides passageways, office space, and cabins. Although hard, the paneling gets scratched, deteriorates around the edges, and eventually flakes. It will be replaced with half-inch thick X-L paneling made of a calcium carbonate component.

Much of the steam, hot and cold water line piping and ducting insulation, running snake-like throughout the vessel, will be replaced as well. The old piping insulation is mostly inch-thick amosite and chrysotile, Walls says, painted over many times. It will be replaced with a 1-inch fiberglass wrap.

Botts says isolating the work area and providing proper ventilation and personal protection are the most important factors in determining how long the job takes. But the crew says the "biggest problem we have is the confined space."



All material must be bagged, decontaminated, and placed in labeled containers for transport to approved burial site.

"Each deck is smaller than the one above," the crew leader points out, "and it's increasingly difficult to maneuver machinery and manpower in the shrinking spaces. The air system equipment, for example, has a 26-inch motor, but the hatches are only 26 inches wide."

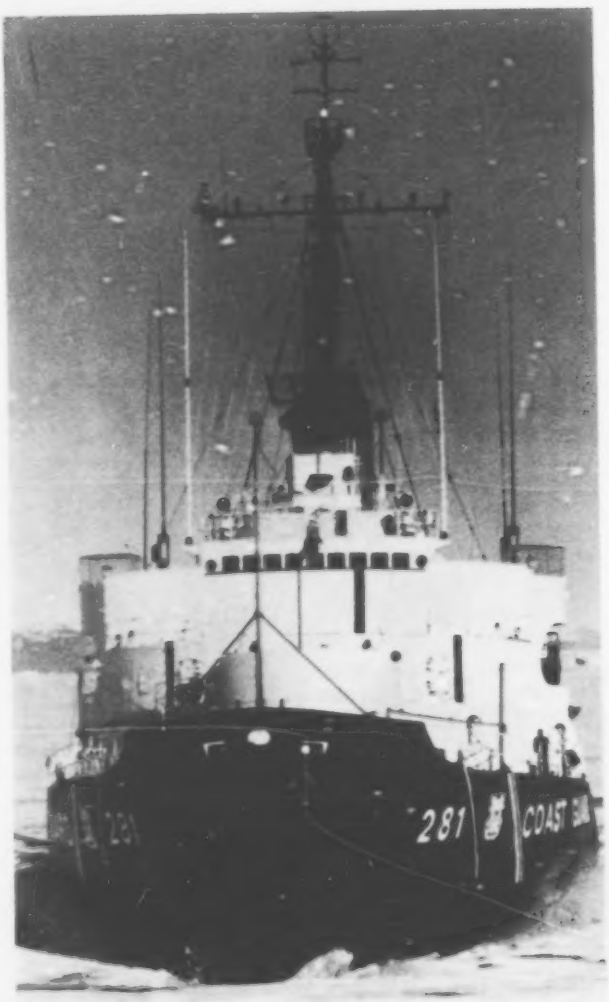
Once the asbestos insulation has been removed, all replacement materials are identified as "asbestos free" by applying a red undercoat sealer. During subsequent repairs, future workers can easily determine whether insulation has asbestos or not by scraping through the exterior paint to expose the red undercoat beneath. Even as the asbestos removal goes on, other workers are busy renovating the vessel's living and work areas, inspecting and repairing bulkheads and tank services, updating electrical circuits, installing new decking and a fuel oil purifier system, and completely overhauling one boiler.

Conclusion

Once the multimillion-dollar renovation is completed this fall, the *Westwind* will join other Coast Guard vessels to continue its icebreaking, search and rescue, law enforcement, and research duties. Combining the Coast Guard's asbestos removal safety program with a thorough rehabilitation ensures the USCGC *Westwind* will truly represent the Coast Guard's *Semper Paratus* (always ready) motto as it carries America's flag proudly over the seas.

Chief Engineer's Comments

As noted in the article, safety precautions must be taken to prevent harmful exposure to asbestos. Per the Asbestos Exposure Control Manual (COMDTINST M6260.16), the Coast Guard safety program strongly emphasizes personnel safety and protection when working with asbestos.



The cutter *Westwind* (281) is just one of the many Coast Guard vessels that have been stripped of asbestos.

Underground Storage Tanks

By Mr. Michael J. Green
Civil Engineering Division
U.S. Coast Guard Headquarters

Introduction

The Resource Conservation and Recovery Act (RCRA) Amendments of 1984 mandated that the Environmental Protection Agency (EPA) establish an underground storage tank (UST) regulatory program. Interim standards for new underground storage tanks became effective May 7, 1985. By May 1986, states were to be notified of existing underground storage tanks in use or abandoned after January 1, 1984. EPA is expected to issue regulations for existing and new underground storage tanks by February 1987. Table 1 summarizes the underground storage tank requirements.

Definitions

An underground storage tank is defined as: any one or combination of tanks that contain an accumulation of a "regulated substance," and whose volume (including the volume of the connected piping) is 10 percent or more below the surface. Excluded from regulation are: (a) tanks containing heating oil burned on site; (b) tanks of 1,100 gallons or less containing motor fuel used for noncommercial purposes at farms or residences; (c) septic tanks; (d) surface impoundments, pits, ponds, and lagoons; (e) storm water and wastewater collection systems; (f) storage tanks located on or above the floor but in an underground location such as a vault, basement, or tunnel; and (g) pipelines regulated under Federal or state laws. Regulated substances are defined as: any substance defined by Section 101 (14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and petroleum, including crude oil and fractions thereof which are liquid at standard temperature and pressure. This includes every substance defined as hazardous.

Notification Requirement

The notification requirement means that all District and Headquarter units should have identified their underground storage tanks and reported their findings to appropriate state agencies by May 8, 1986. If this has not been done, review COMDTINST 16478.4 (Underground Storage Tanks: Storage Requirements), dated February 13, 1986, for notification requirements and addresses of appropriate state agencies. Notification forms (EPA form 7530-1) can be obtained from EPA regional offices, state agencies, or Commandant (G-WP-3), FTS 426-3300, and may be photocopied for future notifications. After May 8, 1986, new tanks must be reported within 30 days of installation. Failure to register tanks may result in civil penalties of up to $10,000 per day per tank. Commandant (G-WP-3) can be of assistance and has requested a copy of the notification forms which have been submitted.

Underground Tank Requirements

A. State Notification, Existing Tanks: Complete by May 1986

1. Tanks in Use	2. Abandoned after January 1, 1974
a. age	a. age, date abandoned
b. size	b. size
c. type	c. type
d. location	d. location
e. uses	e. type and quantity of substance left in tank

B. Interim Standards, New Tanks: Effective May 7, 1985

1. **Prevent releases due to corrosion or structural failure.**
2. **Cathodically protected or noncorrosive material (except when soil resistivity exceeds 12,000 ohm/cm).**
3. **Material compatible with stored substances.**

C. Final Standards (Minimum Requirements): Effective May 1987

1. Existing Tanks	2. New Tanks
a. leak detection or inventory control	a. leak detection
b. record keeping	b. record keeping
c. report releases	c. report releases
d. corrective action	d. corrective action
e. closure	e. closure
	f. financial responsibility

Table 1.

Cause of Leakage

The number and condition of underground storage tanks in the Coast Guard have not been evaluated. When tanks have been tested, some of the tanks and/or their piping have been found to be leaking.

The major cause of leakage is corrosion; therefore, assume old tanks without cathodic protection to be leaking unless proven otherwise by tank testing. It may be more economical to replace these tanks than to attempt to bring them into compliance with the forthcoming regulations (February 1987). Abandoned tanks should be removed as soon as possible to reduce potential environmental effects and enforcement action. Backfilling with sand is not recommended, unless tank removal is not practical, since the sand then becomes a potential hazardous waste. All other tanks and piping should be tested to insure that they are not leaking, including new tanks installed prior to the interim requirements (May 7, 1985). Improperly installed tanks and piping are the second major cause of leakage. (Tanks and piping less than 5 years old have been found to leak.) Of course, leaking tanks should be emptied and appropriate cleanup action initiated immediately.

Regulations

On June 26, 1985, EPA proposed regulations for the tank storage of hazardous waste. (See 50 FR 26444.) On November 29, 1985, EPA proposed that used oil be regulated as hazardous waste. (See 50 FR 49258.) It also proposed standards for recycled used oil. (See 50 FR 49212.) These regulations will require that the tank storage of used oil comply with the proposed regulations for the tank storage of hazardous waste. Districts and units storing hazardous waste or used oil in tanks should review these proposed regulations.

EPA is expected to issue underground tank regulations by February 1987. The regulations are expected to require testing of existing tanks. The National Fire Protection Association (NFPA) Code 329 criterion for tightness testing is 0.05 gallons per hour. EPA has not yet established a standard. A number of tank testing methods are available, and new methods continue to appear on the market. Due to the large volume of liquids involved, changes in temperature, tank deformation, changes in groundwater elevation, vapor pockets, vibrations, evaporation/condensation, and operator/equipment error, many of these testing methods are inaccurate. None of the methods are 100 percent accurate. The Petro-Tite method has been found to be the most reliable but is not applicable in all situations. EPA is presently conducting studies on various testing methods.

Several states already regulate underground storage tanks (e.g., California and Florida), and most others will regulate them eventually. Some states may be more restrictive than Federal regulations. California, for instance, is well ahead of the Federal program and is more restrictive. Federal facilities are required to comply with state requirements where EPA has designated the state primacy for the RCRA program. A state may have primacy for part of the RCRA program but not the tank program. Districts and units in these states should carefully review the state requirements.

Conclusion

The regulation of underground storage tanks is expected to become more and more restrictive in the foreseeable future. Additionally, the cleanup cost where leaks have occurred can be exorbitant; therefore, new tanks should be placed above-ground where space and safety considerations permit. The NFPA Code 30 addresses safety requirements of both aboveground and underground storage tanks. Aboveground tanks must also have a Spill Prevention Control and Countermeasure (SPCC) Plan. (See the Civil Engineering Manual, Chapter 12 and 40 CFR 112.)

Now is the time to initiate an aggressive program to inventory and to test tanks and take corrective action to replace or repair tanks. A management decision to replace tanks now can avoid costly cleanup requirements later.

About the Author

Mr. Michael J. Green, P.E., Civil Engineering Division, Headquarters, graduated with a B.S. degree (1975) and a M.S. degree (1976) from the Pennsylvania State University and joined the civil engineering staff in March 1984. He reviews planning proposals, STRUCTALTS, and environmental and safety documentation; evaluates regulatory changes; prepares notices, instructions, and manual changes; and provides assistance to District and field units where environmental and safety issues are a concern. Previous experience included 4 years with a private consulting firm near Pittsburgh, PA, and 4 years with the U.S. Department of Agriculture, Rural Electrification Administration, Washington, DC.

Chief Engineer's Comments

The Coast Guard prides itself in being environmentally conscious and a good neighbor and will take a lead role in complying with the laws and regulations governing underground storage tanks. This article identifies several deficiencies and problems which need our immediate attention. Commandant (G-CPA), (G-ECV), and (G-WP-3) are cooperating to address this problem and are available to provide assistance.

Fifth R&D Reader's Digest, Part I

By LCDR R. J. Davison
Office of Research and Development
U.S. Coast Guard Headquarters

This Fifth R&D Reader's Digest (Part I) continues a series that began in the Winter 1982 issue of the **Engineer's Digest** (Volume 21, Number 213). Each article is a collection of summaries of recent reports of Coast Guard research and development (R&D) projects. Because every R&D project is documented by a final (and often an interim) report, these articles can be used as a "reader's digest" of what is taking place in the Coast Guard's R&D program.

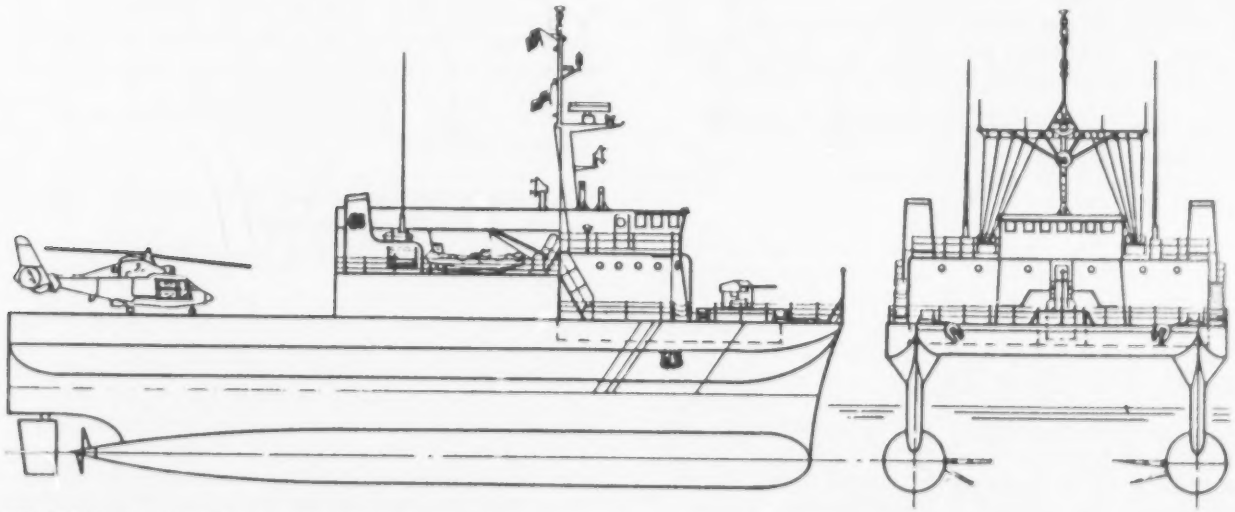
Copies of complete project reports are available from the *National Technical Information Service (NTIS), Springfield, VA 22161*, except where noted. A limited quantity of some of the reports may be obtained from the Office of R&D. Be sure to specify the appropriate accession and Coast Guard report numbers when ordering.

Advanced Marine Vehicles (Acquisition/Technical Support)

"Investigation of the Characteristics of Small SWATH Ships Configured for U.S. Coast Guard Missions"
Report No. CG-D-15-84, Accession No. AD-A-145-581

This report and the several that follow are the result of work performed under the acquisition/technical support element of the R&D's Advanced Marine Vehicles (AMV) Program. This element provides for the program's main output, planned replacement capability acquisition support. The element is divided into two parts: an operations research/operations analysis (OR/OA) part and a technical support part. (The OR/OA part provides the primary inputs for cost-effectiveness analysis. The technical part provides for the development of notional designs for cases when in-service demonstrators of a particular advanced craft are few, thus making information difficult or impossible to obtain otherwise.) An AMV data base is being developed which will eventually contain all pertinent physical and performance features of conventional and advanced craft in the range of interest to the Coast Guard. The data base is updated regularly from technical literature and from the output of two other project elements—full-scale test and evaluation and craft hydrodynamic characteristics.

This report documents the development of four Small Waterplane Area Twin Hull (SWATH) concepts which could perform the missions of Coast Guard cutters ranging from WPBs to the new WMEC *Bear* Class. They will be used to further investigate the characteristics of the SWATH design. Based on the report, it appears that the SWATH could improve the Coast Guard's operational capability in all types of weather. Their seakeeping characteristics may increase the area coverage and mission capability achieveable for a given investment level, particularly if helicopters can be deployed.



750-LTON WMEC SWATH concept with helicopters.

U.S. Coast Guard hybrid concept.

"U.S. Coast Guard Hybrid Concept"
Report No. CG-D-06-85, Accession No. AD-A-156-710

This report documents a study conducted to quantify the effects of adding a buoyancy/fuel tank and a fully submerged foil system to an existing 95-foot WPB. The study shows that this arrangement may have the potential to provide considerable improvement in performance, particularly in the areas of speed, range, endurance, and motions in a seaway. Model tests that were conducted show that vertical accelerations of this hybrid vessel at 30 knots are less than half of those occurring on a 95 running at 18 knots. Further, the potential maximum speed of a hybrid WPB was shown to be 35 knots as compared to a maximum speed of 21 knots for the 95. A refined design is now being developed.

"U.S. Coast Guard Patrol Boat (WPB) Hydrofoil Feasibility Design"
Report No. CG-D-7-85, Accession No. AD-A-155-336

This report describes a study of a hydrofoil design developed to meet WPB mission requirements. The design is of a 35-knot, 137 long ton, fully submerged hydrofoil craft that has an endurance of 5 days. The ship's crew of 16 consists of 2 officers, 2 CPOs, and 12 enlisteds. The payload of 12.5 long tons includes 2.5 long tons of armament. At 30 knots in sea state 5, the hydrofoil design had low values for pitch and roll (0.9 degrees for pitch angle and 0.8 degrees for roll angle). Under these conditions, the vertical accelerations were also very small (0.2 g).

"U.S. Coast Guard Patrol Boat (WPB) Planing Hull Feasibility Study"
Report No. CG-D-9-85, Accession No. AD-A-156-578

This report describes a study of a high-speed planing craft designed to meet the missions of our fleet of 82-foot and 95-foot patrol boats. The craft was designed for close to shore, sea state 3-5, high-speed operations, with a capability for a 5-day mission. It is a 120-foot, 139 long ton, hard chine vessel, capable of a sustained speed of 33 knots in calm water. The hull form for this craft was derived from information obtained from an extensive full- and model-scale test program conducted on the U.S. Navy's CPIC-X prototype craft and from evaluation of other small-planing combatant craft tested and operated by the Navy. Calculations and estimates were performed using the techniques and information routinely employed for similar craft, including a planing hull feasibility design program (PHFMOPT).

"Conceptual Design of Four Surface Effect Ships for U.S. Coast Guard Application"
Report No. CG-D-13-85, Accession No. AD-A-158-200

This report presents details of surface effect ship (SES) designs developed to meet mission requirements of the WHEC, WMEC, WLB, and WPC. The report presents the background, the requirements, and the analysis related to the concept design developments. A technical appendix presents technical descriptions, design characteristics, and layout drawings for each of the four ship types.

"PATROL User's Guide and Model Description"
Report No. CG-D-20-85 (Accession No. not yet available. Contact G-DMT-2, 472-5770, for assistance.)

This report documents a computer-based analytical model (PATROL) which has been developed to evaluate the effectiveness of advanced marine vehicles and conventional vessels in performing law enforcement missions. It is currently installed on the R&D's VAX 11/750 computer.

Inputs that are required for the program include cutter characteristics—transit speed, search speed, intercept speed, sweep width, and several others—and a description of the scenario—concept of operation, area of operation, and traffic patterns. With the input, the model will compute a number of measures of effectiveness, including interdiction rate, tonnage seized, and the number of smugglers seized.

Four classes of output are generated by the model: summary of inputs, allocation of effort (number of occurrences in each phase of a L/E patrol and average time in each phase), performance measures, and logistics (fuel-consumption profile and mission-speed profile).

The computer model has been developed so that it can be used in analytical applications other than analysis of advanced marine vehicles. Additionally, it can be used to evaluate tactics and policy decisions in various scenarios and environments.

R&D follow-on actions based on this report are to continue efforts to integrate this model with others under development and to continue to support the evolution of this model.

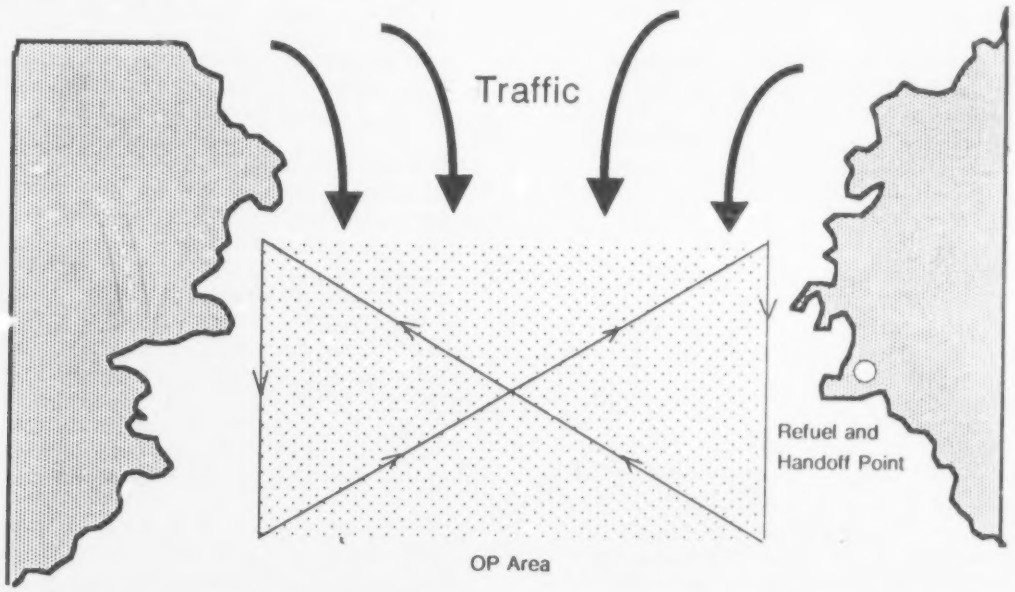
Advanced Marine Vehicles (Full-Scale Test and Evaluation)

"Technical Evaluation of the RHS 200 for High-Speed Ferry Applications and Coast Guard Missions"
Report No. CG-D-07-84, Accession No. AD-A-144-673

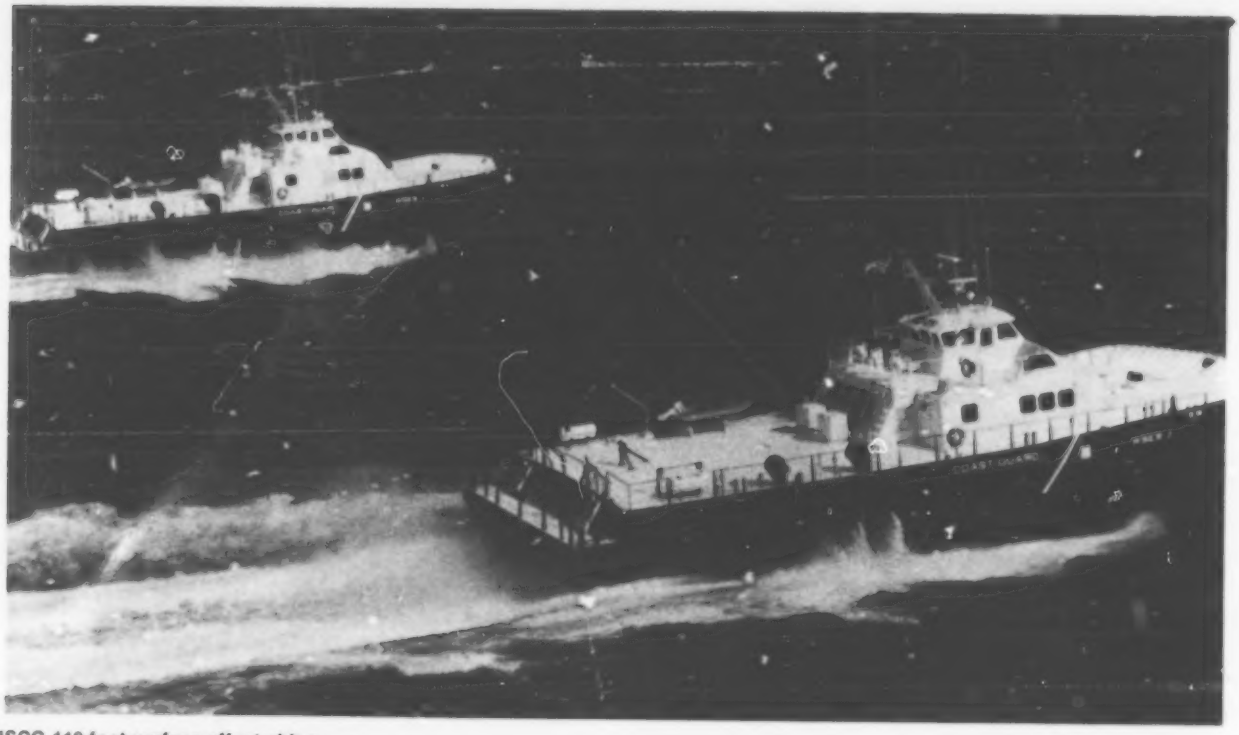
This report and the several that follow are the result of work performed under the full-scale test and evaluation element of the R&D's AMV program. This element provides the primary full-scale input to the AMV data base. Activities of this element include technical evaluations, operational evaluations, and demonstrations.

The evaluation documented by this report provided extensive information on the 125 long ton Rodriquez Cantiere Navale surface piercing hydrofoil ship (RHS 200). The effort included testing of ship takeoff power, time and distance requirements, hullborne and foilborne turning, bollard pull and underway towing capabilities, emergency stopping distances, and the effect of the flap-controlled seakeeping augmentation system on ship motions.

The RHS 200 achieved an average ship speed of 30 knots while operating in sea state 5 head seas. The vessel's speed, seakeeping performance, reliability, and maintainability are attractive features for both Coast Guard patrol boat and passenger ferry applications, despite its short range and poor maneuverability limit application as a Coast Guard patrol boat. The RHS 200 would require alteration or redesign in the areas of fire protection, passenger access, and subdivision to meet the Coast Guard's regulations for passenger ferries of this size.



Typical search pattern used in patrol model.



USCG 110-foot surface effect ships.

"Design, Development, and Testing of a Prototype Digital Ride Control System for Surface Effect Ships, Part VIII: Test on XR-1E SES"
Report No. CG-D-31-84, Accession No. AD-A-150-443

This report describes the installation and performance of a prototype digital ride control system (RCS) on the Navy test craft, XR-1E SES. The XR-1E SES is a 26-ton, low length-to-beam ratio, surface effect ship.

The objectives of this joint Coast Guard/Navy project included verifying proper shipboard operation of the system prior to installation on the Navy's SES 200, predicting RCS performance on the USCG *Sea Bird*-Class SES (WSESs), and specifying RCS configuration and installation requirements for our WSESs.

The purpose of the RCS on the surface effect ship is to modulate cushion airflow to increase SES heave damping and raise the heave resonant frequency. This action can substantially reduce vertical accelerations due to wave action, thereby improving the ride quality by reducing fatigue and increasing crew effectiveness.

Study results predict that the RCS will significantly reduce the standard deviation of heave acceleration on the WSES in various sea states. The Office of R&D is now under contract with Maritime Dynamics to install a RCS on one of our WSESs for further testing and evaluation.

"Seakeeping and Vibration Tests of the Coast Guard 110-Foot Surface Effect Ship *Sea Bird* Class (WSES)"
Report No. CG-D-32-84 (Accession No. not yet available. Contact G-DMT-2, 472-5770, for assistance.)

This report documents several tests that were conducted aboard the Coast Guard's surface effect ships from December 1982 to August 1984. Information was obtained on the ride quality of the SES in 2- to 4-foot seas. Roll and pitch angles as well as vertical accelerations of the vessel were measured at various speeds and heading relative to the major swell direction.

The craft demonstrated excellent roll and pitch stability; however, vertical accelerations (heave) were significant in 2.5- to 4-foot seas. The most severe accelerations were encountered in head seas at full speed (28 knots). These vertical motions are at a relatively "high" frequency (1-2 hertz). Vibration frequencies in the range of 1-80 hertz cause human fatigue and are not usually encountered in conventional displacement vessels. The ISO standard for the fatigue decreased proficiency limit was exceeded in less than 12 hours, and the exposure limit was exceeded generally within the first day underway.

Further testing is scheduled to evaluate the effectiveness of an air-cushion RCS in reducing the high frequency fatiguing motions encountered on this SES Class.

"Side-by-Side Buoy Tender Evaluation, Seakeeping, and Maneuvering Comparisons of the USCGC *Mallow* (WLB 396) and the SSP *Kaimalino* (Semi-Submersible Platform)"
Report Number CG-D-34-84, Accession No. AD-A-153-613

The evaluation documented by this report demonstrated that *Kaimalino*, a SWATH ship, can perform extremely well as a buoy tender platform.

The tests, conducted in 5- to 10-foot seas off the island of Oahu, HI, in March 1983, demonstrated that this 89-foot SWATH ship has superior seakeeping compared to the 180-foot buoy tender. (The SWATH ship is an extremely stable platform capable of tending buoys in rough seas with very little motion.) *Kaimalino* rolled less than ½ degree while tending buoys in 6.8-foot beam seas while *Mallow* rolled 7 degrees in the same conditions.

"SES 200 Technical Evaluation Test Report"
Report NO. CG-D-1-85, Accession No. AD-A-152-344

This report describes an extensive technical evaluation that was performed on the U.S. Navy's surface effect ship (SES 200) for the Navy and Coast Guard. The evaluation was performed to validate previous research which had shown that for ocean-capable vessels, length-to-beam ratios of 4-1 or greater offer efficient operation at task force speeds without compromising the SES advantage of operating at significantly higher speeds. This balanced performance is attributable to shifting the peak of the high-wave drag region, known as "hump," outside the operating envelope. The SES 200 is a modified version of the Coast Guard's 110-foot WSESs. The 200 was stretched 50 feet to attain the desired length-to-beam ratio.

In November 1984, the Coast Guard assumed operational control of the SES 200 for a 6-month operational evaluation. The results of the testing will become available in the near future.

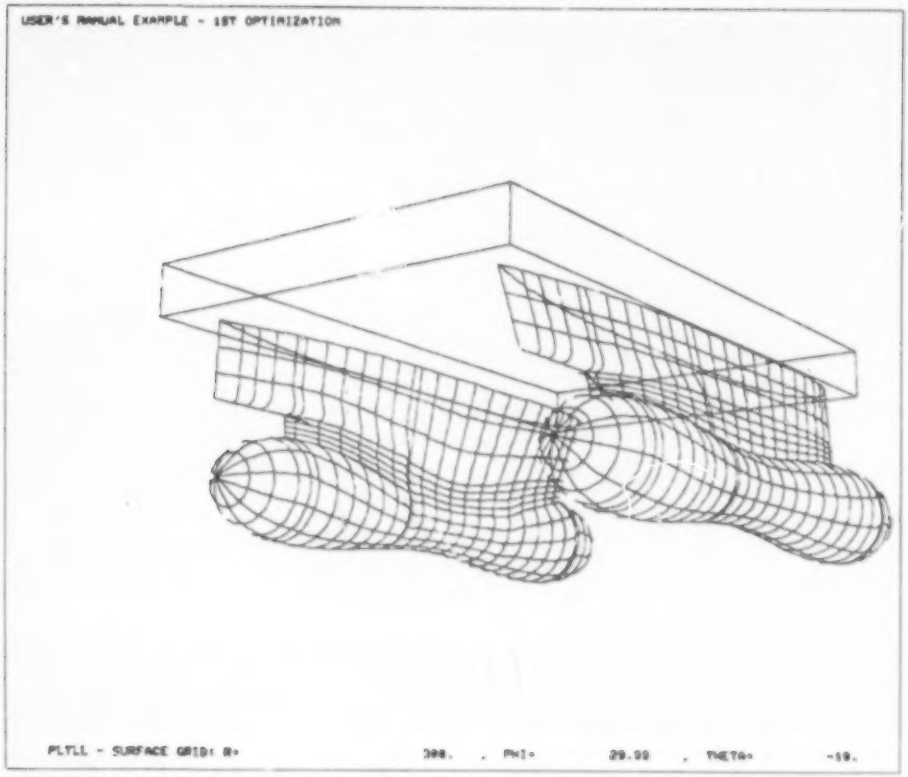
"Comparative Characteristics of U.S. Coast Guard 95-Foot and 82-Foot Class Patrol Boats (WPB)"
Report No. CG-D-21-85 (Accession No. not yet available. Contact G-DMT-2, 472-5770, for assistance.)

This report documents a study conducted to compare calm water and seakeeping performance of the Coast Guard's 95-foot and 82-foot WPB-Class patrol vessels. Data was collected in calm water for speed vs. power and fuel consumption, zig-zag, spiral and tactical runs, and noise levels. Seakeeping evaluations included side-by-side ships' motions comparisons.

Seakeeping performance measured during a side-by-side test of *Cape Fairweather* and *Point Knoll* in 3-foot waves demonstrated very little difference in roll and pitch motions between the 82 and 95. Noise levels on the 95-foot WPB, however, were excessive in living spaces during moderate- and high-speed operations. (The Office of Engineering has been able to reduce noise levels since this technical evaluation.)

The data collected in this evaluation will be incorporated into the AMV data base to support the WPB vessel acquisition.

***Cape Fairweather* undergoing performance testing.**



SWATHGEN output: Faired hull (looking forward) optimized form.

Advanced Marine Vehicles (Craft Hydrodynamic Characteristics)

"SWATHGEN Computer-Aided Design Program User's Manual"
Report No. CG-D-8-85, Accession No. AD-A-154-859

This report is the result of work performed under the craft hydrodynamic characteristics element of the R&D's AMV program. This element provides a means for obtaining performance data for designs that do not exist in service. Literature reviews, model tests, and computer modeling have been the major activities conducted under this element.

This report documents an interactive computer design program which was developed to aid in the design of the underwater portion of a SWATH. The program, written in FORTRAN 77 on a VAX 11/780, models the underwater hull and strut, uses a simple box to represent the upper hull, and constructs a fairing surface between the lower hull and the strut. (The results are presented graphically.) Quantities of interest, such as the displaced volume, center of buoyancy, surface area, maximum draft, and maximum beam, are then calculated. SWATHGEN interfaces with two other program modules: REPOW, a program that calculates the resistance of the hull, and OPTVOL, a program that contours the lower hull to minimize wave resistance. The designer may use these tools as an aid in arriving at the best hull form for a given design.

About the Author

LCDR Davison is currently assigned to the technical assessment staff (G-DT), Office of Research and Development (R&D). Prior to this assignment, he attended the Naval Postgraduate School, Monterey, CA, where he received a M.S. degree in operations research. Other assignments include operations officer aboard CGC Midgett; communications officer on CGC Klamath; and duty at both VTS San Francisco and the Thirteenth District RCC, Seattle, WA. LCDR Davison is a 1971 graduate of the Officer Candidate School. Prior to joining the Coast Guard, he attended the University of Washington where he received a B.S. degree.

LCDR Davison would like to thank the many project officers in the Office of R&D who contributed material for this article.

Chief Engineer's Comments

The Office of Research and Development should be commended for its continuing effort to keep the Coast Guard at the forefront of technology. Many of the studies described offer stimulating reading to the interested professional. New technology and variations to existing technology in ship design and computer usage have been studied to increase the Coast Guard's data base and improve mission effectiveness.

Of particular interest to the naval engineer are the many reports concerning patrol boat improvements and advanced marine vehicle designs. The extensive studies completed with existing patrol boats, surface effect ships, small waterplane area twin hull ships, hydrofoils, and planing hulls provide us with valuable background information for the design of new ships and boats. Other reports on computer simulations, ride control systems, and mission areas are of interest to all Coast Guard personnel.

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